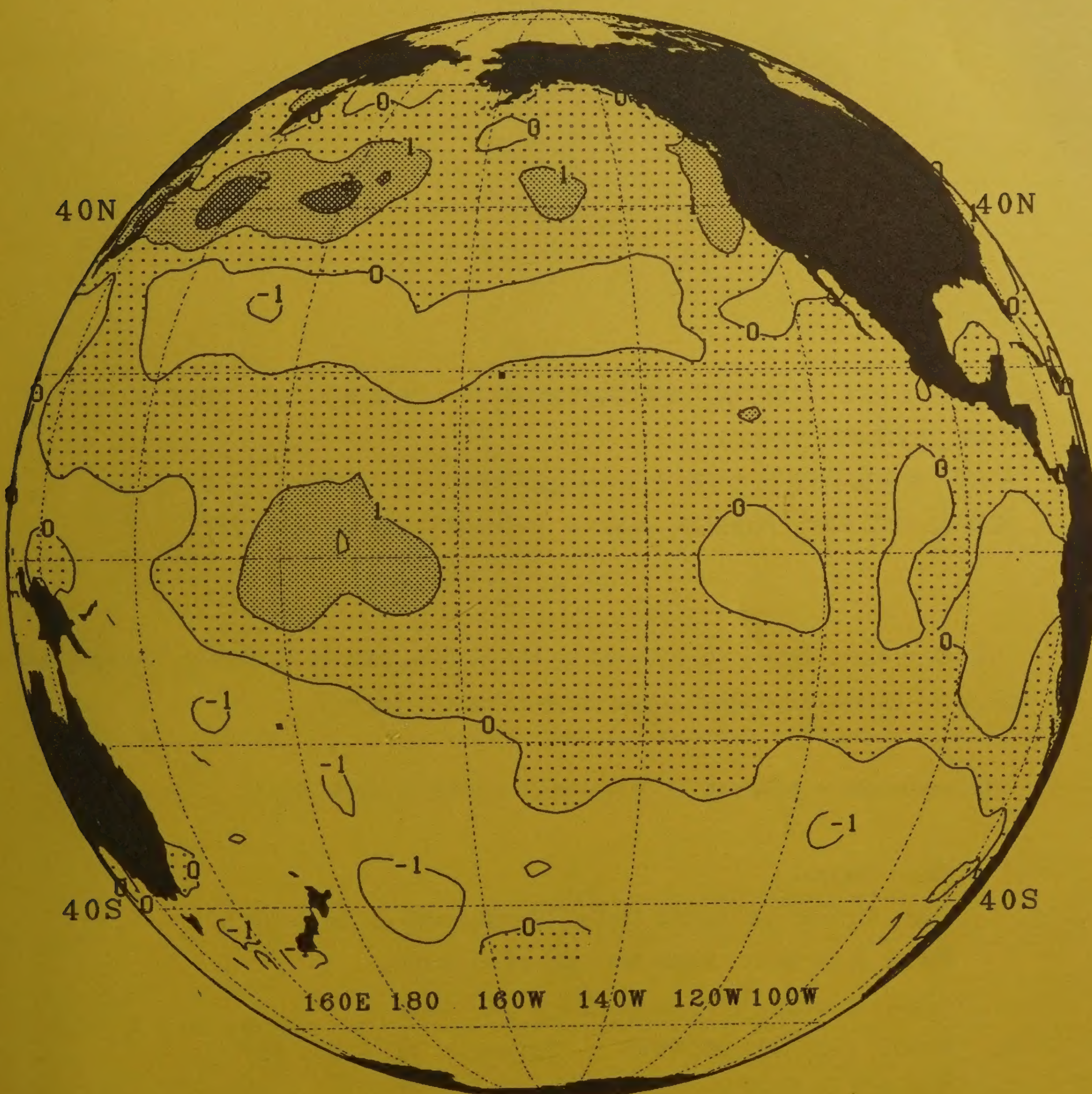
気象庁海洋月報

Monthly Ocean Report

September 1994 (No. 21)



El Niño Monitoring Center
Japan Meteorological Agency

気象庁海洋気象部海洋課
エルニーニョ監視センター

平成6年9月

気象庁海洋月報は、気象庁海洋気象部海洋課エルニーニョ監視センターで作成されています。
本月報に関する問い合わせは、

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Monthly Ocean Report is prepared by the El Niño Monitoring Center, Oceanographical Division, Marine Department, Japan Meteorological Agency.

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表紙は1994年９月の太平洋の月平均海面水温偏差図です。
陰影部は平年より高温の海域を示しています。

The figure on the front cover shows the monthly mean SST anomalies for September 1994 in the Pacific Ocean.
Areas of positive anomalies are shaded.

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海況の特徴（１９９４年９月）

太平洋の海況

太平洋赤道域の海面水温は、170°Ｅから165°Ｗにかけて平年より１℃以上高かった。南米沖では1994年３月以降平年より低い状態が続いていたが、負偏差域は小さくなった。エルニーニョ監視海域（4°Ｓ～4°Ｎ、150°Ｗ～90°Ｗ）の海面水温偏差は、0.0℃だった（第１表、第１図、第６図）。

赤道域表層の28℃以上の暖水層は、170°Ｗ付近で先月より厚さを増し、深さ100m以上に達した。日付変更線付近では、先月に引き続いて30℃以上の暖水がみられ、深さ60mまで占めている（第３図）。

北太平洋では、40°Ｎに沿って本州東方から170°Ｗにかけて平年より１～２℃高かった。アラスカ湾沖では平年より1℃以上高い状態が続いていた。一方、20～30°Ｎの160°Ｅから135°Ｗにかけて平年より低かった（第１図）。

気象庁の海洋気象観測船「凌風丸」は、７月上旬～８月中旬に日本の南岸からニューギニア島北部までの137°Ｅに沿う海洋観測を実施した。ここで得られた海水中のフロン11の観測結果をiiiページに紹介する（Ａ図）。

日本近海の海況

日本近海は、南西諸島周辺で平年より低いほかは、全般に平年より0.5～2℃高く、特に、本州東方と日本海では2℃以上高かった（第17図）。

黒潮は日本の南岸に沿ってほぼ直進し、房総半島沖を東に流れていた（第20図）。

本州東方の親潮系の冷水（深さ100ｍで5℃以下）は、沿岸寄りの分枝は40.3°Ｎ・144.2°Ｅまで、沖合の分枝は39.7°Ｎ・147.6°Ｅまで、それぞれ達していた（第19図）。

熱帯の気象

赤道域の対流活動は、160°Ｅより西側の海洋大陸付近で平年より不活発、東側の日付変更線付近で活発であった。赤道域の下層東西風は、太平洋東部で先月までの東風偏差が西風偏差に転じたため、太平洋赤道域のほぼ全域で西風偏差となった。南方振動指数（ＳＯＩ）は -1.6と大きな負の値が今月も継続した（第１表、第12図、第13図）。

［気象庁長期予報課提供］

HIGHLIGHTS September 1994

Pacific

Sea surface temperatures (SSTs) in the equatorial Pacific were more than 1°C above normal between 170°E and 165°W. Negative SST anomalies continued off the South America, but to a reduced area. The SST index for region B (Fig. 6) was 0.0°C (Table 1 and Figs. 1 and 6).

The thickness of surface warm water (above 28°C) along the equator has increased around 170°W since the last month and exceeded 100 m. The warmest water greater than 30°C has been observed near the date line since the last month, and the warmest water reached about 60 m (Fig. 3).

In the North Pacific, SSTs were above normal along 40°N from east of Honshu to 170°W, and continued to be more than 1°C above normal off the Gulf of Alaska. SSTs between 20°N and 30°N from 160°E to 135°W were below normal (Fig. 1).

R/V Ryofu Maru of JMA carried out hydrographic observation along 137°E in July and August. The vertical section of CFC-11 concentration along 137°E is introduced on Page iii (Fig. A).

Seas adjacent to Japan

SSTs in the seas adjacent to Japan were 0.5-2°C above normal except around the Nansei Islands. East of Honshu and in the Japan Sea, SSTs were notably more than 2°C above normal (Fig. 17).

The Kuroshio flowed straight along the south coast of Japan, then flowed eastward off the Boso Peninsula (Fig. 20).

The Oyashio cold water (below 5°C at a 100 m depth) extended southward to 40.3°N, 144.2°E and 39.7°N, 147.6°E, respectively (Fig. 19).

Atmospheric conditions in the tropics

Convective activities over the equatorial Pacific were weaker than normal west of 160°E, and stronger than normal from 160°E to the date line. In the equatorial Pacific, low level easterlies had weakened. Consistent with this feature, low level easterlies were weaker than normal throughout the equatorial Pacific. The SOI has continued to have a large negative value (-1.6) (Table 1 and Figs. 12 and 13).

[Prepared by the Long-range Forecast Division, JMA]

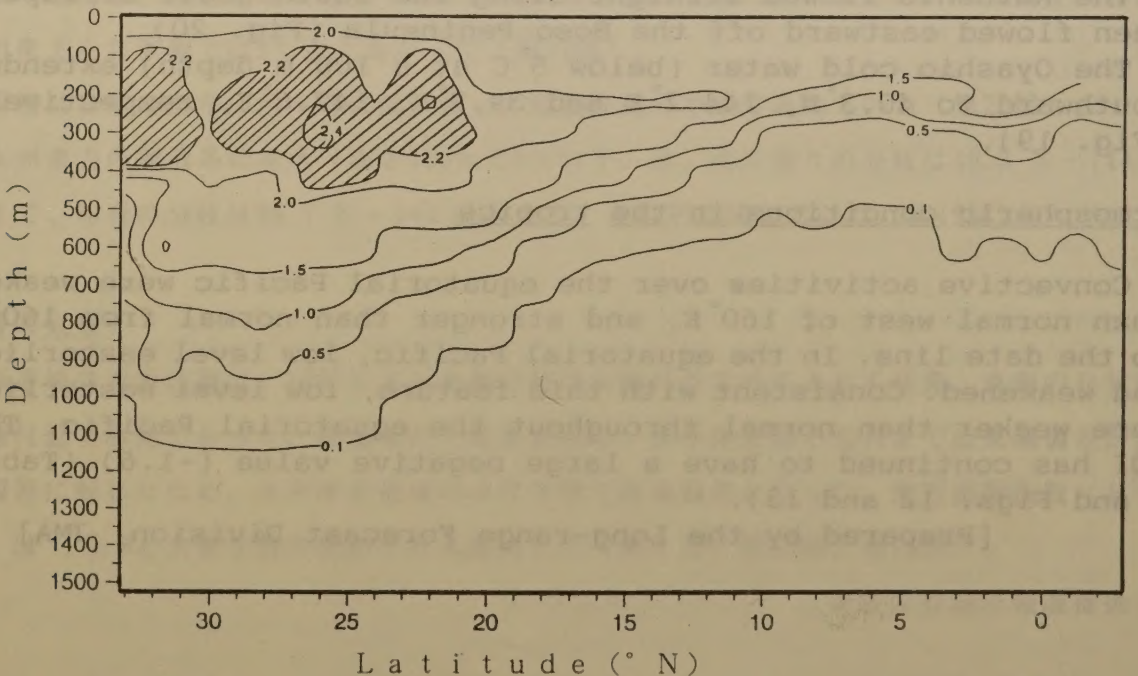
Meridional vertical section of CFC-11 concentration along 137°E

フロンは、もともと自然界に存在しない物質であるが、近年スプレーやクーラーの冷却剤等として大量に使用され、急速に大気中に蓄積されてきた。大気中に放出されたフロンは、さらに海水中に溶け込んで広がりつつある。フロンは化学的に極めて安定であり、海水中での広がり方を追跡することによって、海洋の循環の実態把握に役立つことから、世界海洋循環実験（ＷＯＣＥ）計画では重要な観測項目のひとつである。

気象庁の海洋気象観測船「凌風丸」は、ＷＯＣＥ計画の中で、７月上旬～８月中旬に日本の南岸からニューギニア島北部までの137°Ｅに沿う海洋観測を実施し、海水中のフロン11を観測した。今回の観測では、フロン11は26°Ｎ、深さ300 m付近で最も多く、24°Ｎ以北では深さ1000 mより深い層まで達していることがわかった。

CFCs are anthropogenic compounds widely used as refrigerants, aerosol propellants, plastic foam agents, and solvents. As a result of such a wide use, they have been accumulated increasingly in the atmosphere, and are now dissolving and expanding into the ocean. The CFCs are so chemically stable that we can use them as tracers in the ocean. Since tracers in the ocean can be used to estimate the speed and direction of the oceanic circulation, it has become one of the most important issues in the World Ocean Circulation Experiment (WOCE) to measure CFCs as accurately as possible.

Within the WOCE programme, R/V Ryofu Maru of JMA carried out hydrographic observation along 137°E in July and August. The result of CFC-11 observation shows that the maximum concentration of CFC-11 is at a depth of 300 m at 26°N, with CFC-11 reaching layers deeper than 1000 m north of 24°N.



図－A　137°Eに沿うフロン11 (pmol/kg)の鉛直断面
（気象庁の海洋気象観測船「凌風丸」による1994年7～8月の観測結果から）

Fig. A　The meridional vertical section of CFC-11 concentration (pmol/kg) along 137°E observed by R/V Ryofu-Maru of JMA in July and August of 1994.

Date		1993									1994								
		APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Pacific Sea Surface Temperature (℃)																			
D	(14N～ Eq.)	28.6	28.8	29.2	29.1	28.9	29.1	29.1	29.5	29.1	28.4	28.5	28.6	29.1	29.4	29.6	29.2	29.3	29.1
	(130E～150E)	-0.2	-0.3	-0.1	-0.1	-0.2	-0.1	-0.2	+0.3	+0.2	-0.1	+0.2	+0.2	+0.3	+0.3	+0.3	0.0	+0.2	-0.1
A	(4N～ 4S)	28.7	29.0	29.1	29.1	28.8	29.1	28.8	28.9	28.7	28.2	28.0	28.2	28.4	28.9	29.0	29.2	29.4	29.1
	(160E～150W)	+0.5	+0.5	+0.6	+0.6	+0.4	+0.8	+0.4	+0.5	+0.5	+0.2	0.0	+0.1	+0.2	+0.4	+0.5	+0.7	+1.0	+0.8
B	(4N～ 4S)	28.1	28.0	27.0	25.8	24.9	24.8	25.0	25.2	25.3	25.7	26.1	26.9	27.0	26.8	26.3	25.1	24.6	24.6
	(150W～ 90W)	+1.0	+1.4	+0.9	+0.6	+0.3	+0.2	+0.4	+0.6	+0.4	+0.3	-0.1	0.0	-0.1	+0.2	+0.2	-0.1	0.0	0.0
C	(Eq.～ 10S)	26.4	25.2	23.3	22.1	21.0	20.8	21.3	21.5	22.8	24.7	26.0	25.3	24.2	23.4	22.2	21.2	20.6	19.9
	(90W～ 80W)	+1.3	+1.3	+0.6	+0.5	+0.4	+0.5	+0.6	0.0	+0.2	+0.4	+0.3	-0.6	-0.9	-0.5	-0.5	-0.4	0.0	-0.4
Pacific Sea Level Anomaly (cm)																			
YAP	(10N, 138E)	1	-2	-2	1	-1	5	8	8	10	7	7	6	2	2	7	8	1	
RABAUL	(4S, 152E)	-12	-13	-11	-8	-9	-7	-6	-5	-2	-1	3	4	5	3	1	2	0	
MAJURO	(7N, 171E)	-8	-1	6	5	3	1	5	2	3	2	2	3	5	1	-2	-1	0	
TARAWA	(1N, 173E)	3	5	6	4	7	4	6	2	1	6	-1	6	6	7	6	9	-	
CHRISTMAS	(2N, 157W)	6	5	-1	-2	-1	-1	-2	-1	-7	-3	-7	0	0	1	1	4	7	
SANTA CRUZ	(1S, 90W)	7	10	4	0	0	1	3	0	0	-1	0	-4	-8	-3	1	0	1	

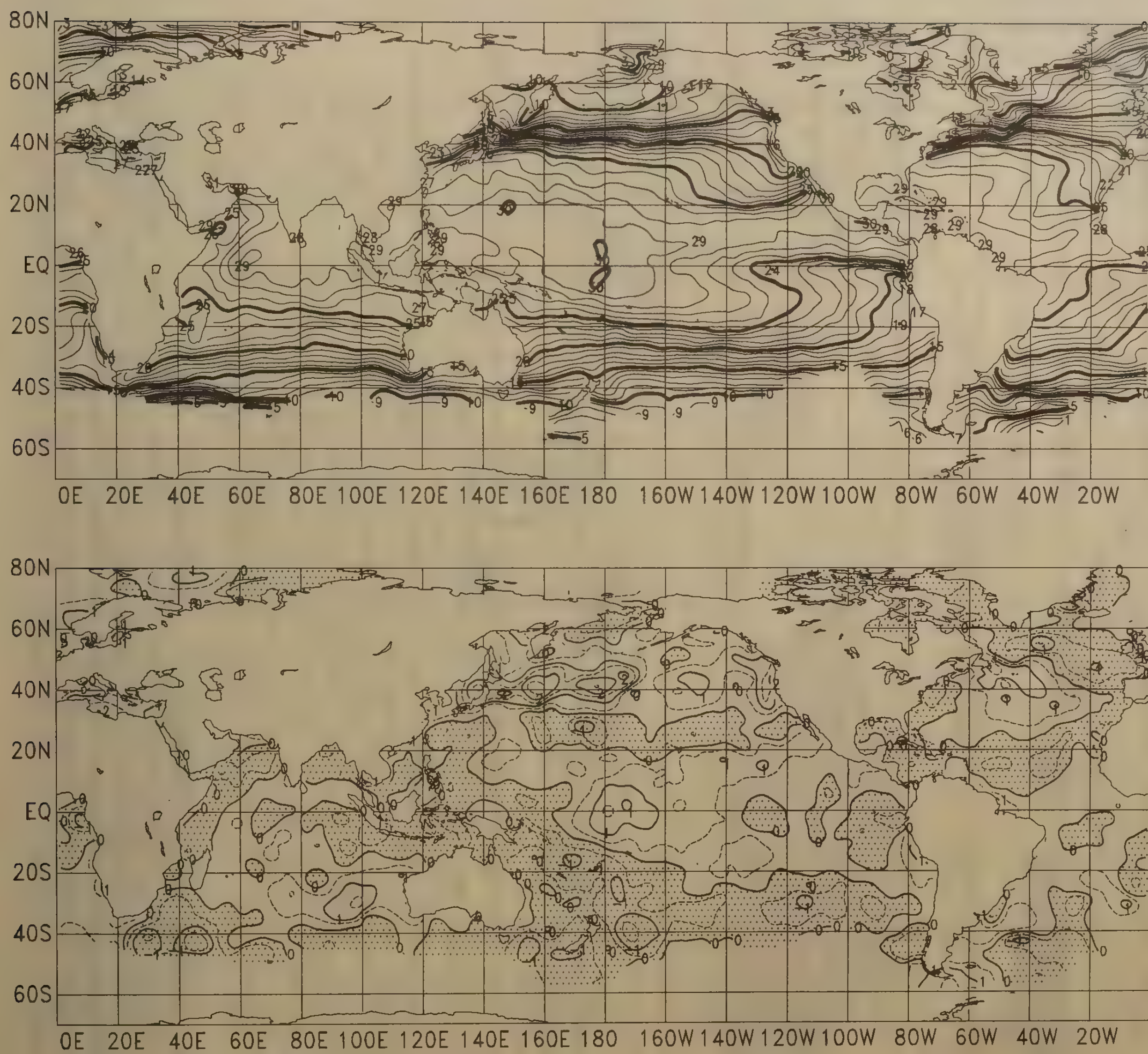
第１表（a）エルニーニョ監視指数

Table 1(a) El Niño monitoring indices. Data sources are the El Niño Monitoring Center, JMA for the sea surface temperature and the SOC of ISLP-PAC, Department of Oceanography, University of Hawaii for the sea level anomaly.

Date	1993									1994								
	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Southern Oscillation Index																		
SOI (TAHITI-DARWIN)	-1.9	-0.8	-1.6	-1.0	-1.5	-0.7	-1.4	-0.0	0.2	-0.2	0.1	-0.8	-2.1	-1.4	-1.0	-1.6	-1.8	-1.6
TAHITI (17.5S, 150W)	-0.7	0.2	-0.6	-1.1	0.0	-0.0	-0.9	0.1	-0.0	-0.1	0.0	-0.1	-1.5	-0.8	-0.9	-1.5	-0.7	-1.5
DARWIN (12.5S, 131E)	1.9	1.4	1.3	0.4	2.2	1.4	1.3	0.1	-0.5	0.3	-0.2	1.7	1.2	1.0	0.3	1.0	2.0	1.5
High Cloud Amount Index																		
HCLD-PH (20N ～ 10N) (110E ～ 140E)	-0.5	-2.2	-1.9	-0.5	-0.4	0.7	-0.1	-0.6	1.2	-0.5	-0.5	0.6	0.7	0.2	-0.3	3.5	-0.9	0.2
HCLD-MC (5N ～ 5S) (110E ～ 135E)	0.3	-1.4	-2.1	-1.0	-1.4	-1.0	-1.5	-0.8	-0.2	-0.4	-0.5	0.8	0.4	0.4	-1.0	-1.1	-1.1	-1.1
HCLD-DL (5N ～ 5S) (170E ～ 170W)	2.8	2.0	1.8	1.3	0.3	1.8	1.7	-0.2	0.0	0.0	-0.7	-0.6	0.4	-0.3	-0.3	-0.5	0.4	1.4
Equatorial Zonal Wind Index																		
U200-IN (5N ～ 5S) (80E ～ 100E)	-0.3	0.5	0.4	-0.3	-0.5	-2.1	-0.7	-0.8	-1.8	-0.4	-0.8	-1.5	-0.2	-0.3	-0.5	-1.2	-0.6	-0.9
U200-CP (5N ～ 5S) (180 ～ 125W)	-0.6	-1.3	-0.0	1.1	0.3	-0.3	0.0	-0.5	0.4	0.4	0.8	0.2	-0.3	-0.5	-0.7	0.4	0.0	0.1
U850-WP (5N ～ 5S) (160E ～ 175W)	0.8	0.5	0.3	0.1	0.7	-0.0	0.9	-0.4	-0.7	-1.2	-1.0	-0.6	-0.5	-0.3	-0.4	0.1	0.6	0.4
U850-CP (5N ～ 5S) (170W ～ 135W)	0.3	0.6	0.6	-0.8	0.1	0.2	0.4	0.3	-0.5	-0.6	-0.9	-0.2	-0.4	0.2	-0.6	-0.1	0.0	0.3
U850-EP (5N ～ 5S) (130W ～ 100W)	0.5	0.9	0.7	-0.4	0.8	1.0	0.2	0.9	0.2	0.1	-0.4	0.1	-0.5	0.0	-0.5	-1.3	-1.8	0.9

第１表（b）エルニーニョ監視指数(続き)

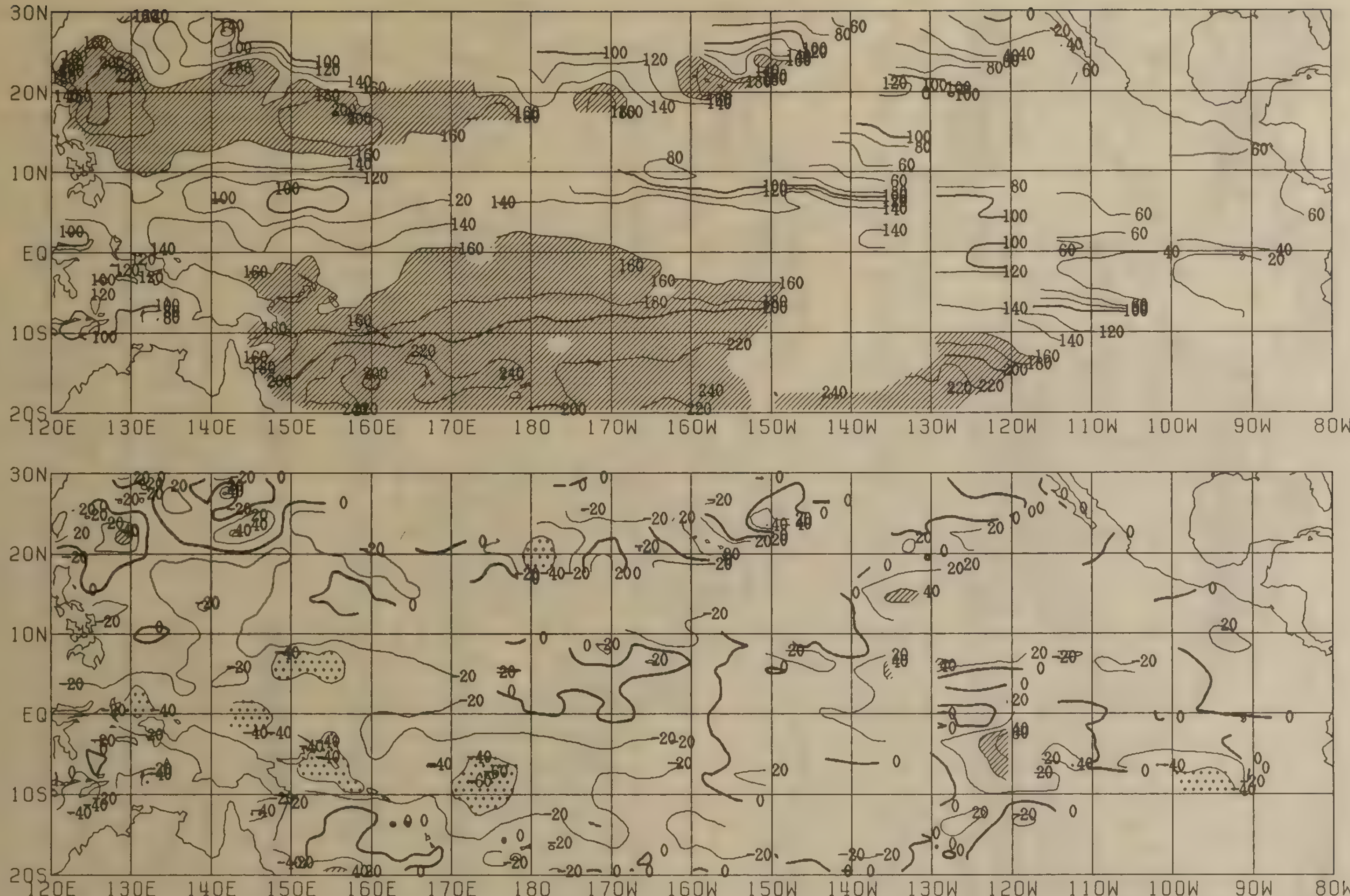
Table 1(b) El Niño monitoring indices (continued).
Data source for these atmospheric conditions is the Long-range Forecast Division, JMA.



第１図　全球月平均海面水温図（上）及び偏差図（下）（1994年 9月）

Fig.1 Monthly mean sea surface temperature in the global ocean (top) and anomalies (bottom) for SEP 1994. Anomalies are computed with respect to the JMA climatology (1961–90) (Climatic charts of sea surface temperatures of the western North Pacific and the global ocean, March 1991). The Contour interval is 1° C and additional anomaly contours of ±0.5° C are shown as broken lines. Negative anomalies are stippled.

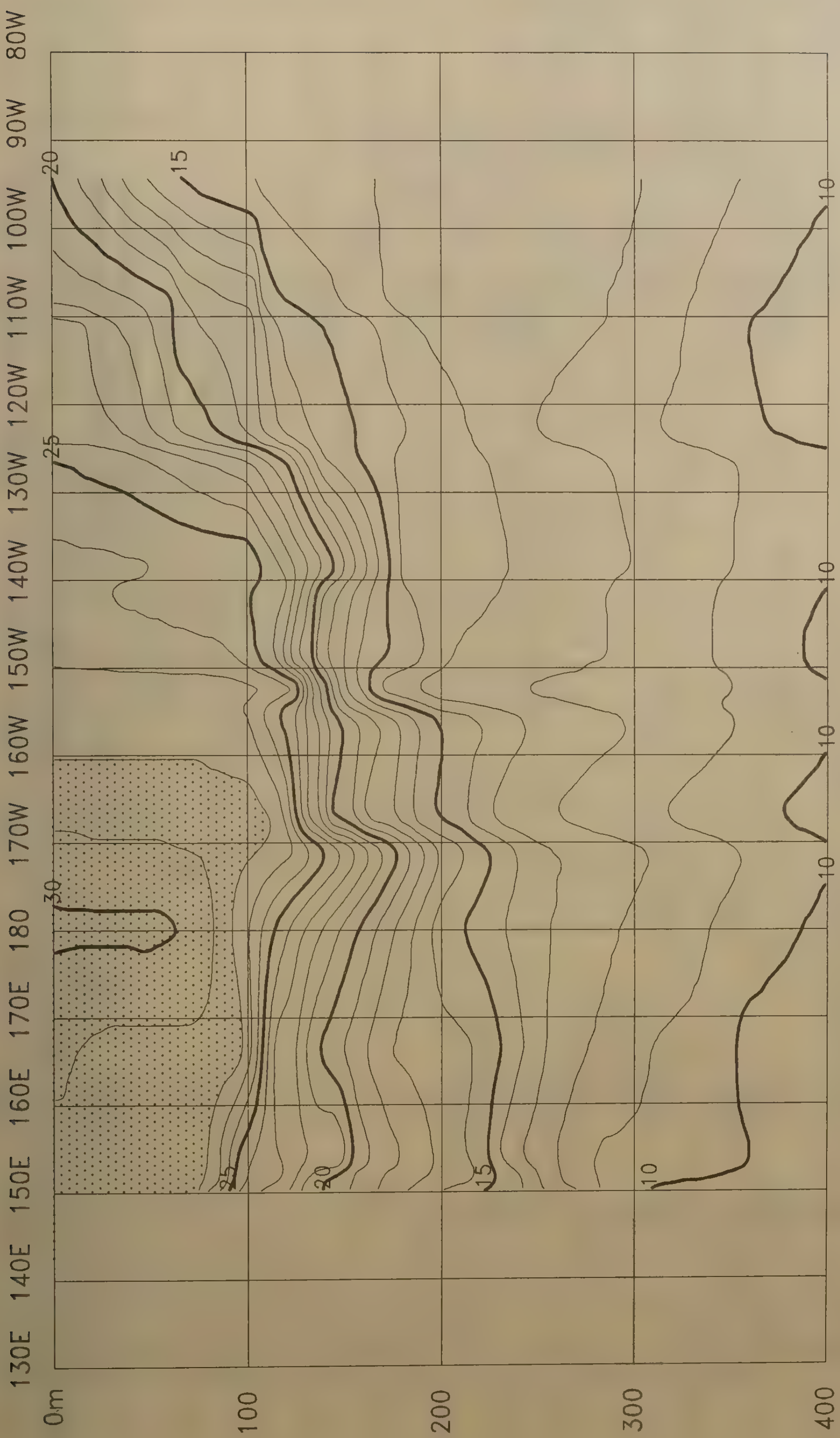
Depth of 20°C & Anomalies in the Pacific Ocean



第２図　太平洋表層水温（20℃深度）図（上）及び偏差図（下）（1994年 9月）

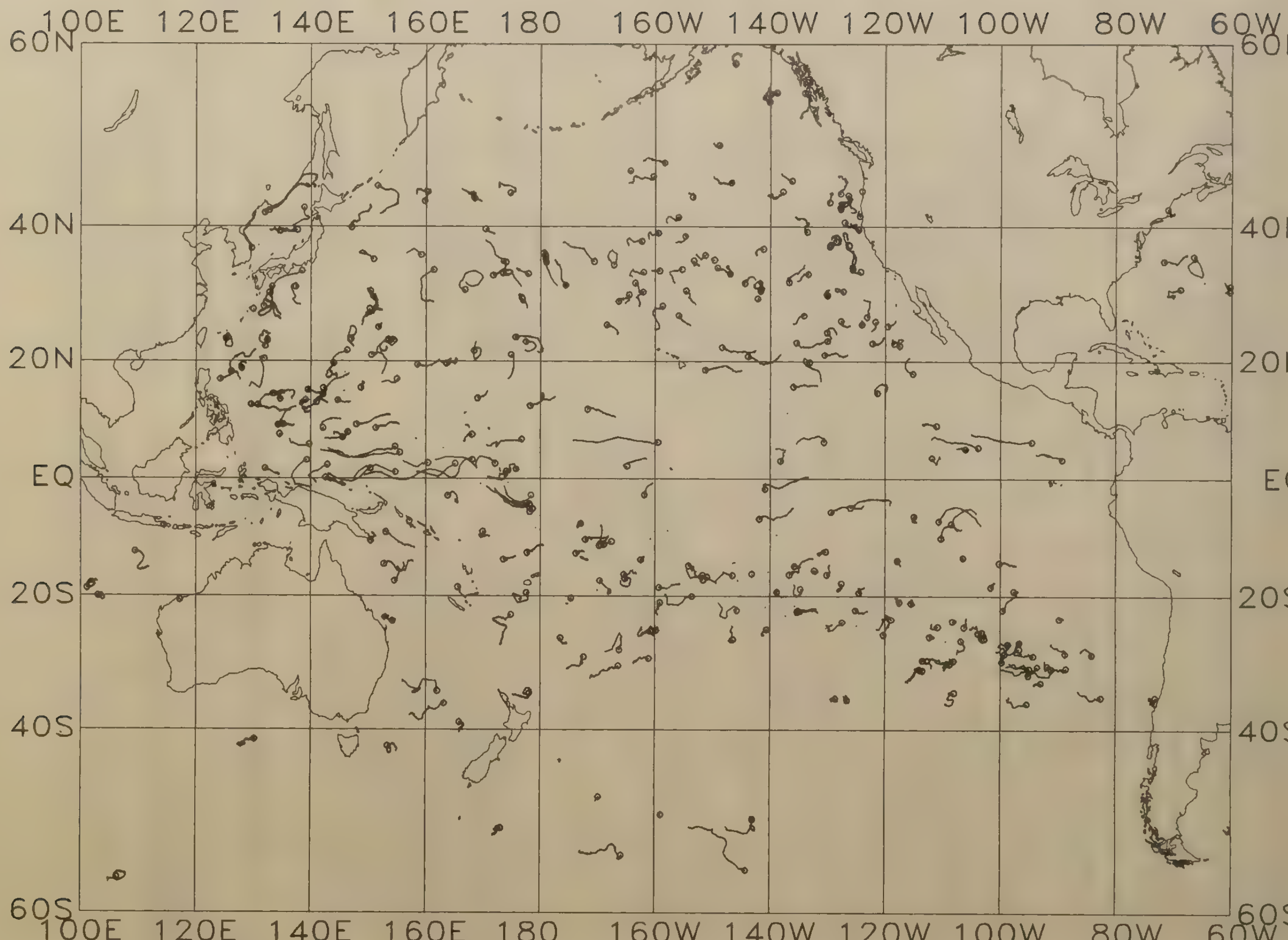
Fig.2　The depth of a 20°C isotherm in the Pacific Ocean (top) and anomalies (bottom) for SEP 1994.　Anomalies are computed with respect to the climatology (Levitus, 1982, Climatological Atlas of the World Ocean, NOAA).
The contour interval is 20m with shading for values greater than 160m (top), and shading/stippling for values greater/smaller than +40m/−40m (bottom).

Depth−Longitude Section of Ocean Temperature



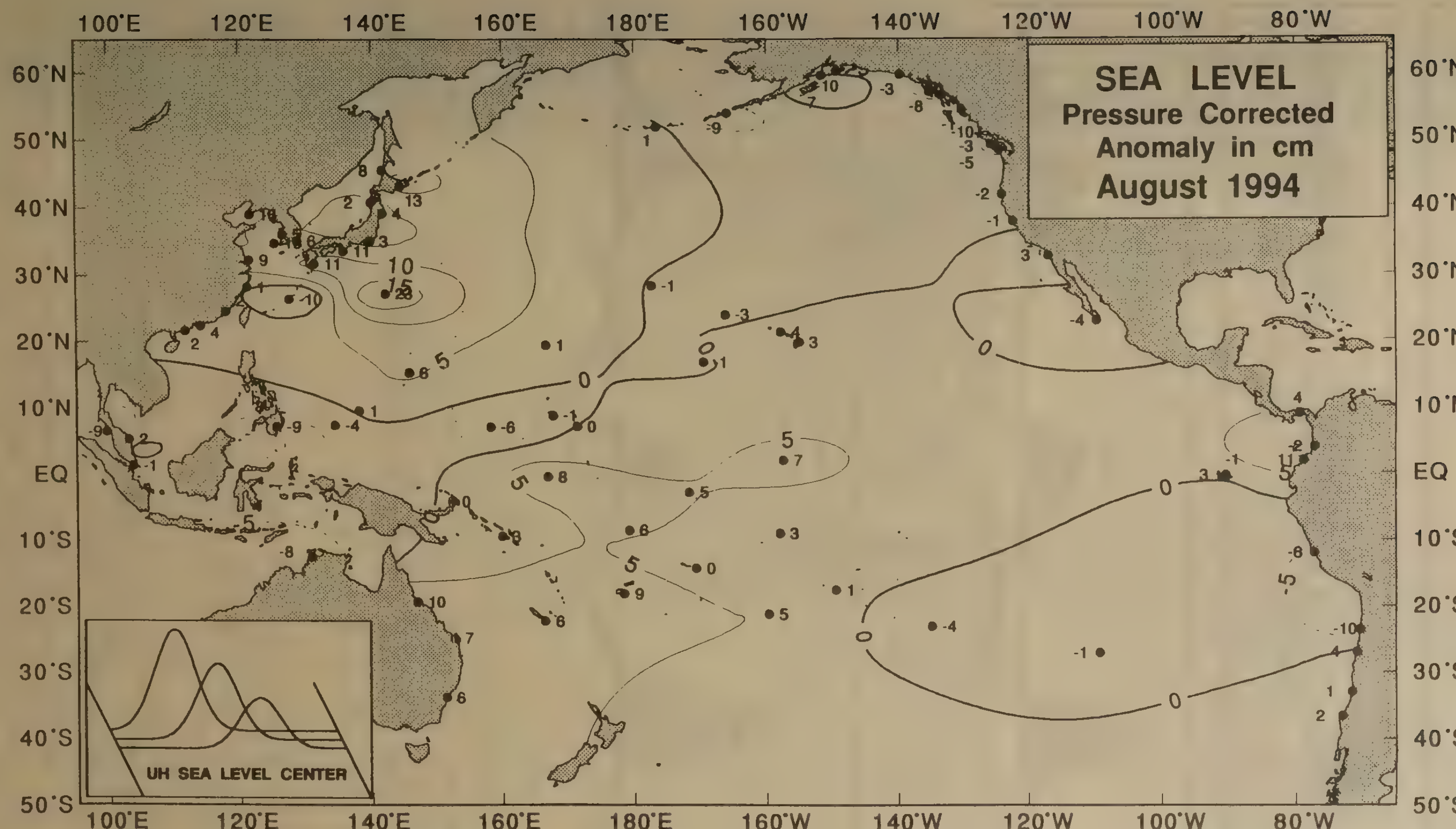
第３図　太平洋赤道に沿う表層水温断面図（1994年 9月）

Fig.3 Depth−longitude section of the Pacific Ocean temperature along the equator for SEP 1994. The contour interval is 1° C with spotted shading for values greater than 28° C.



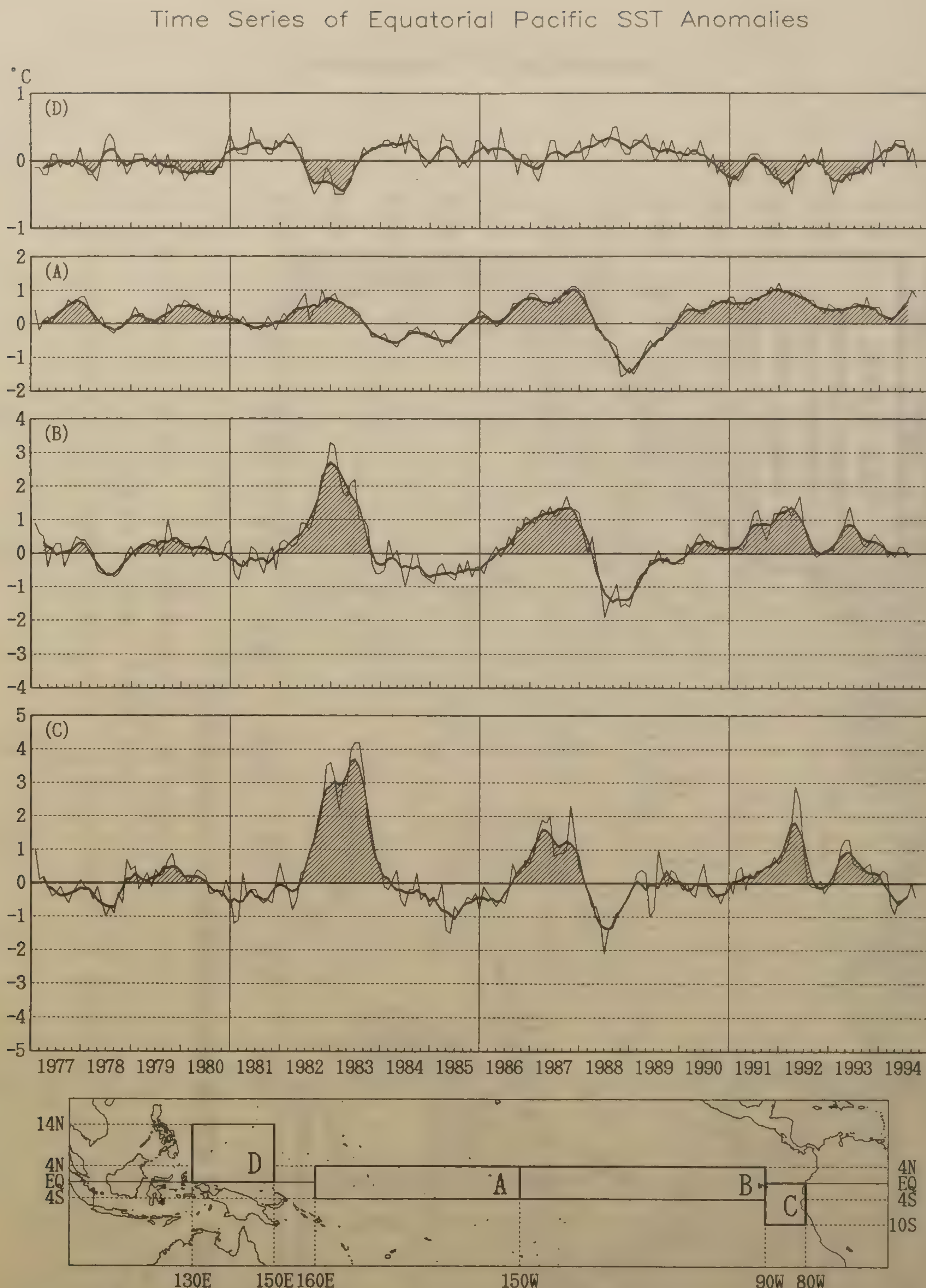
第4図　太平洋ブイ流跡図(1994年 9月)

Fig.4　Movements of drifting buoys in the Pacific Ocean during SEP 1994. Each track is one buoy, with the small circle representing the buoy's last position for the month.



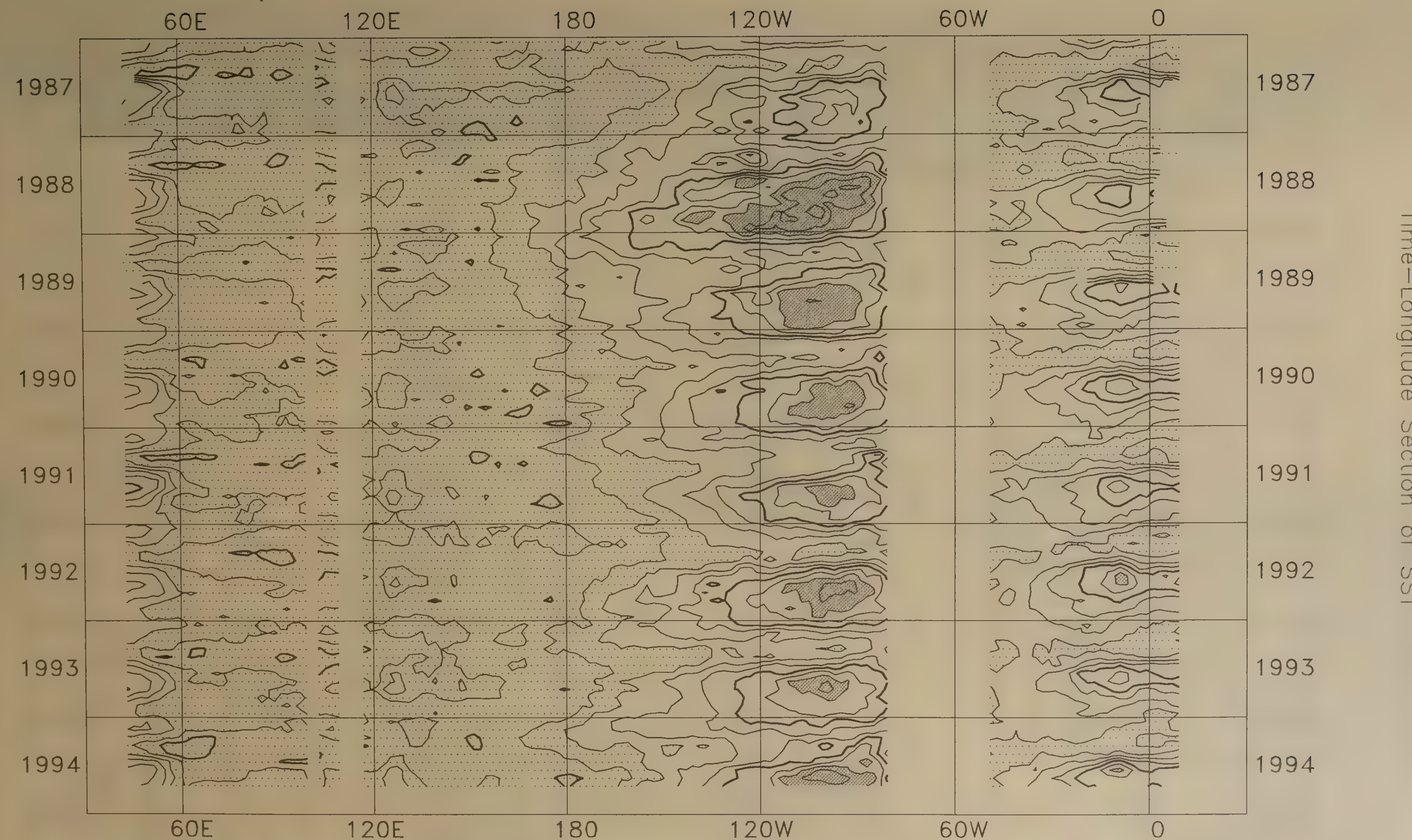
第5図　太平洋海面水位偏差図（ 1994年 8月 ）

Fig.5　Sea level anomalies obtained from the 1975 to 1986 mean AUG sea level adjusted for atmospheric pressure (AUG 1994).
This figure is prepared by the SOC of ISLP−PAC, Dept. of Oceanography, Univ. of Hawaii.



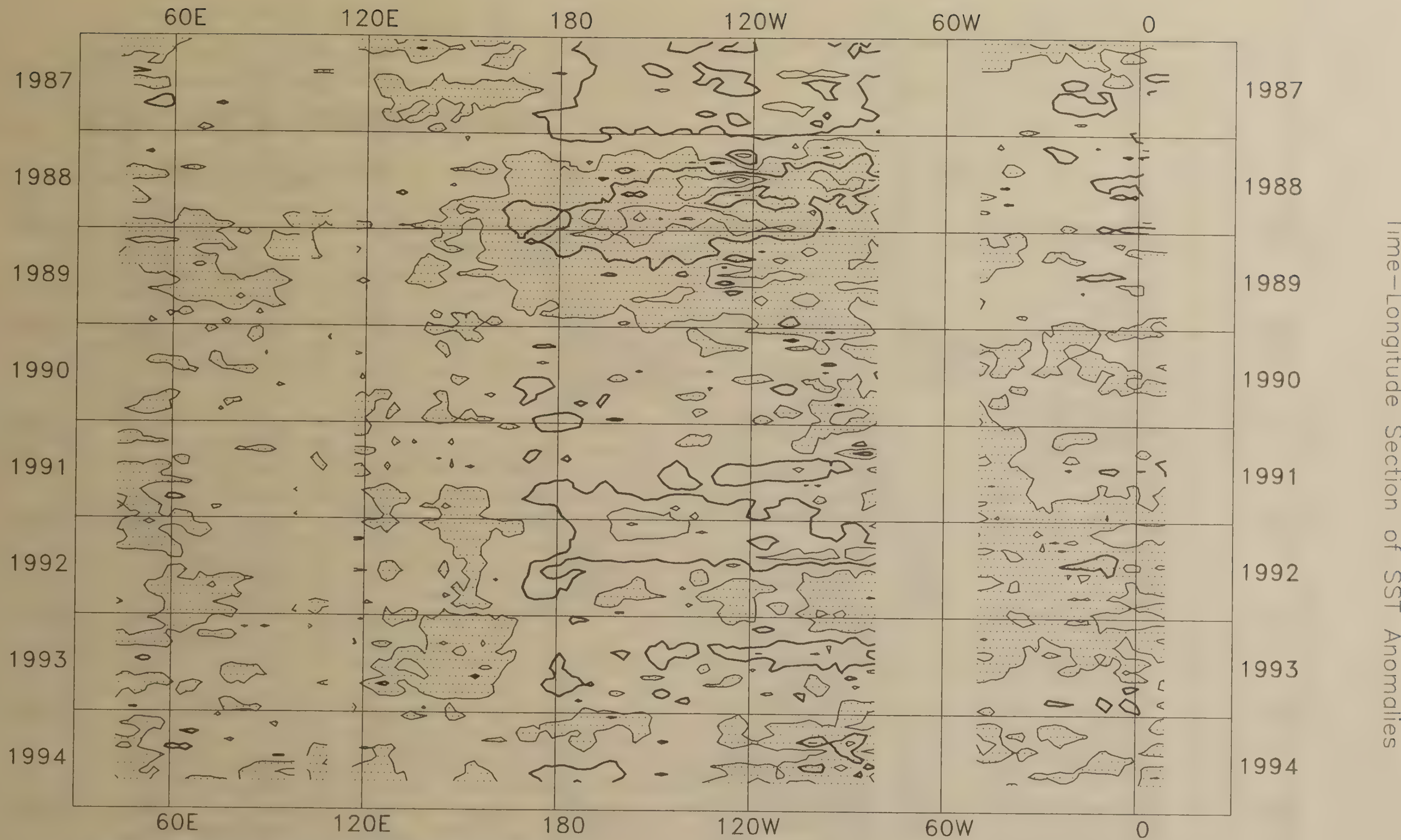
第６図　赤道太平洋海面水温偏差時系列図

Fig.6 Time series of monthly mean SST anomalies in the equotorial Pacific Ocean for the areas indicated at the bottom of the figure. Thin lines show the monthly values and thick lines their 5 month running mean. Positve anomalies (A,B,C) and negative anomalies (D) are shaded. Anomalies are computed with respect to the JMA climatology (1961–90).



第7図　赤道に沿う海面水温時系列図

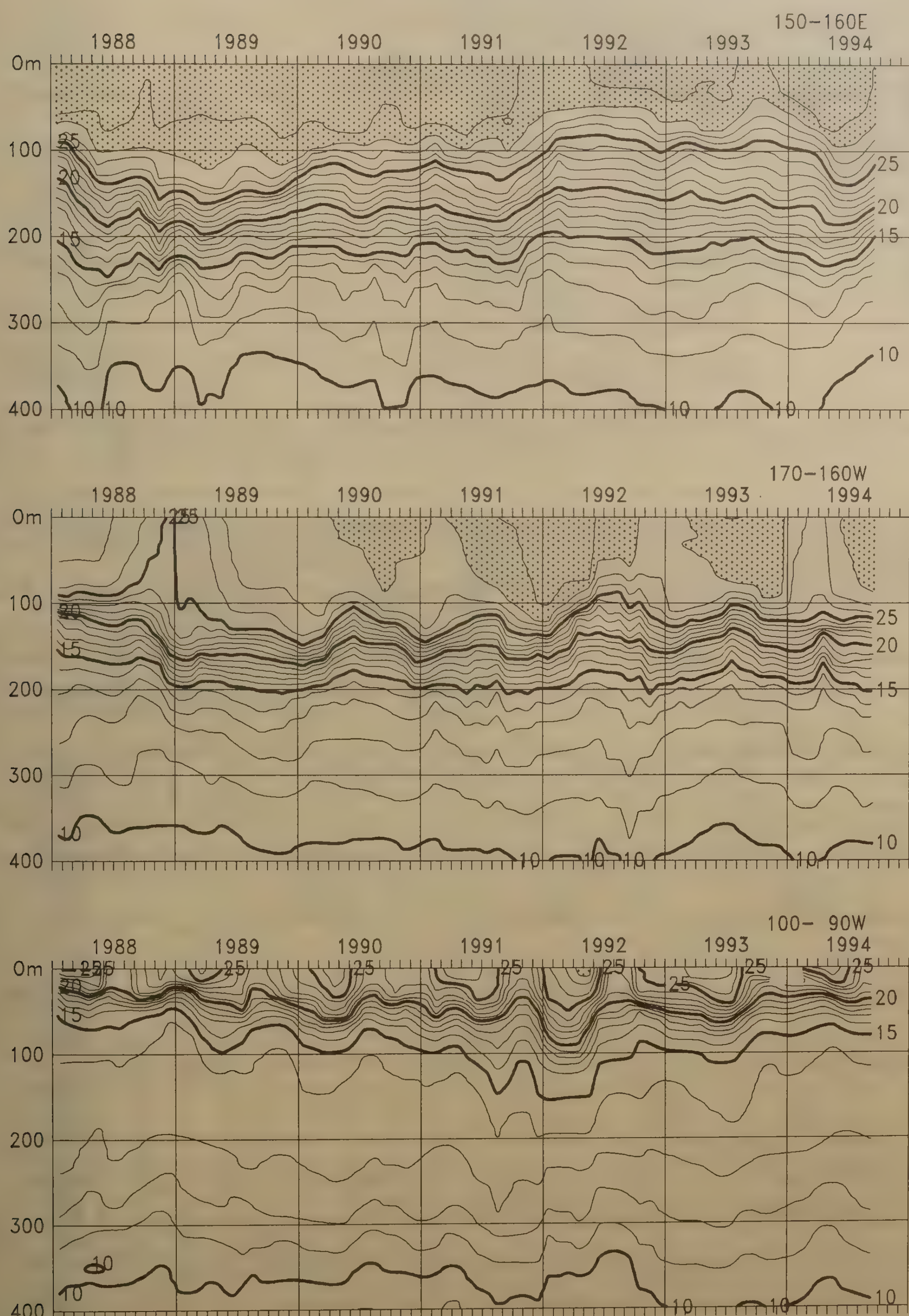
Fig.7 Time-longitude section of SSTs along the equator (2° N–2° S) in the global ocean. The contour interval is 1° C, with thick contour lines at 25 and 30° C. SST values greater than 28° C are spotted and values less than 23° C are shaded.



第8図　赤道に沿う海面水温偏差時系列図

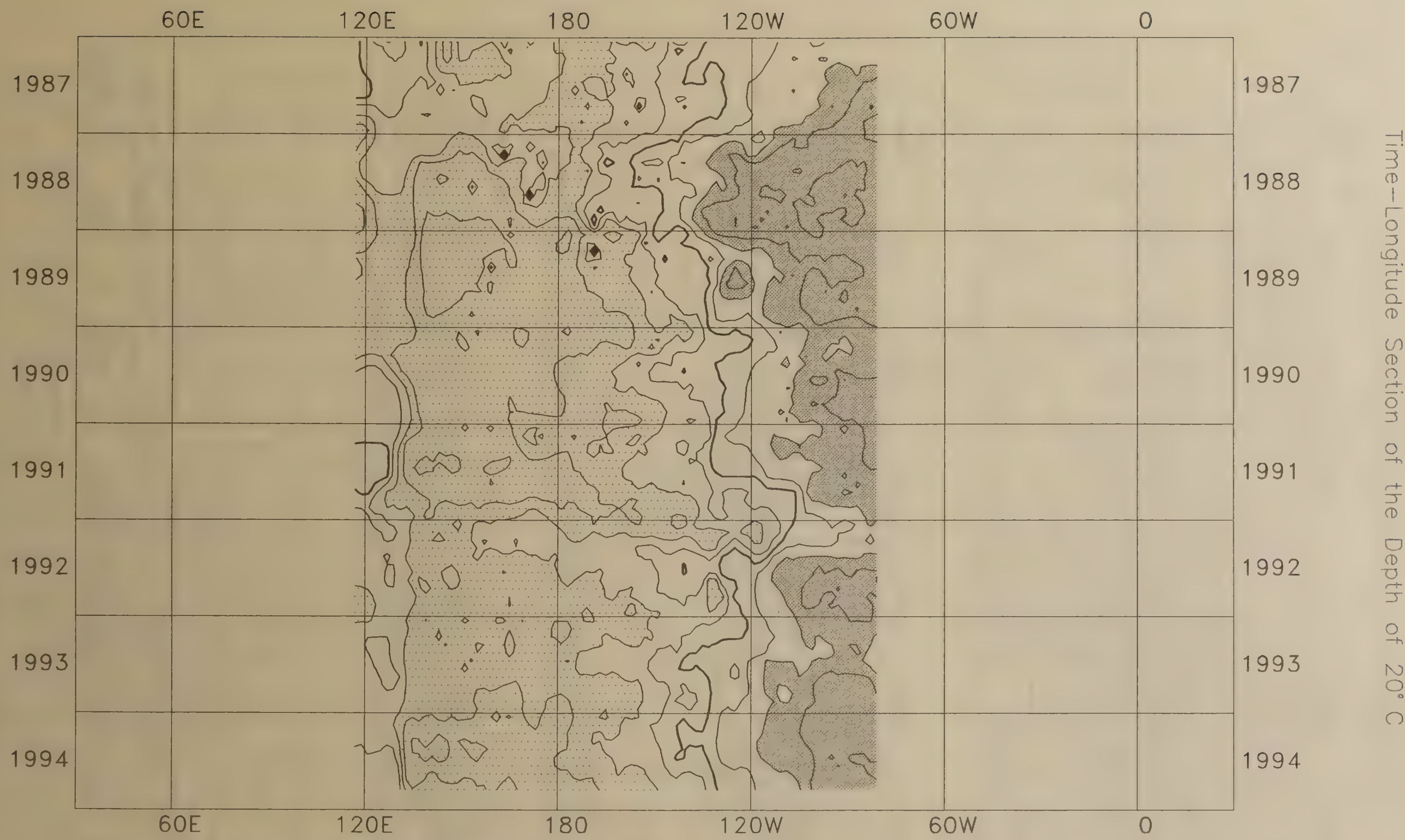
Fig.8 Time-longitude section of SST anomalies along the equator (2° N-2° S) based on the JMA climatology (1961-1990). The contour interval is 1° C, with thick contour lines at +1° C and -1° C. Negative anomalies are spotted.

Time Series of Equatorial Subsurface Temperature



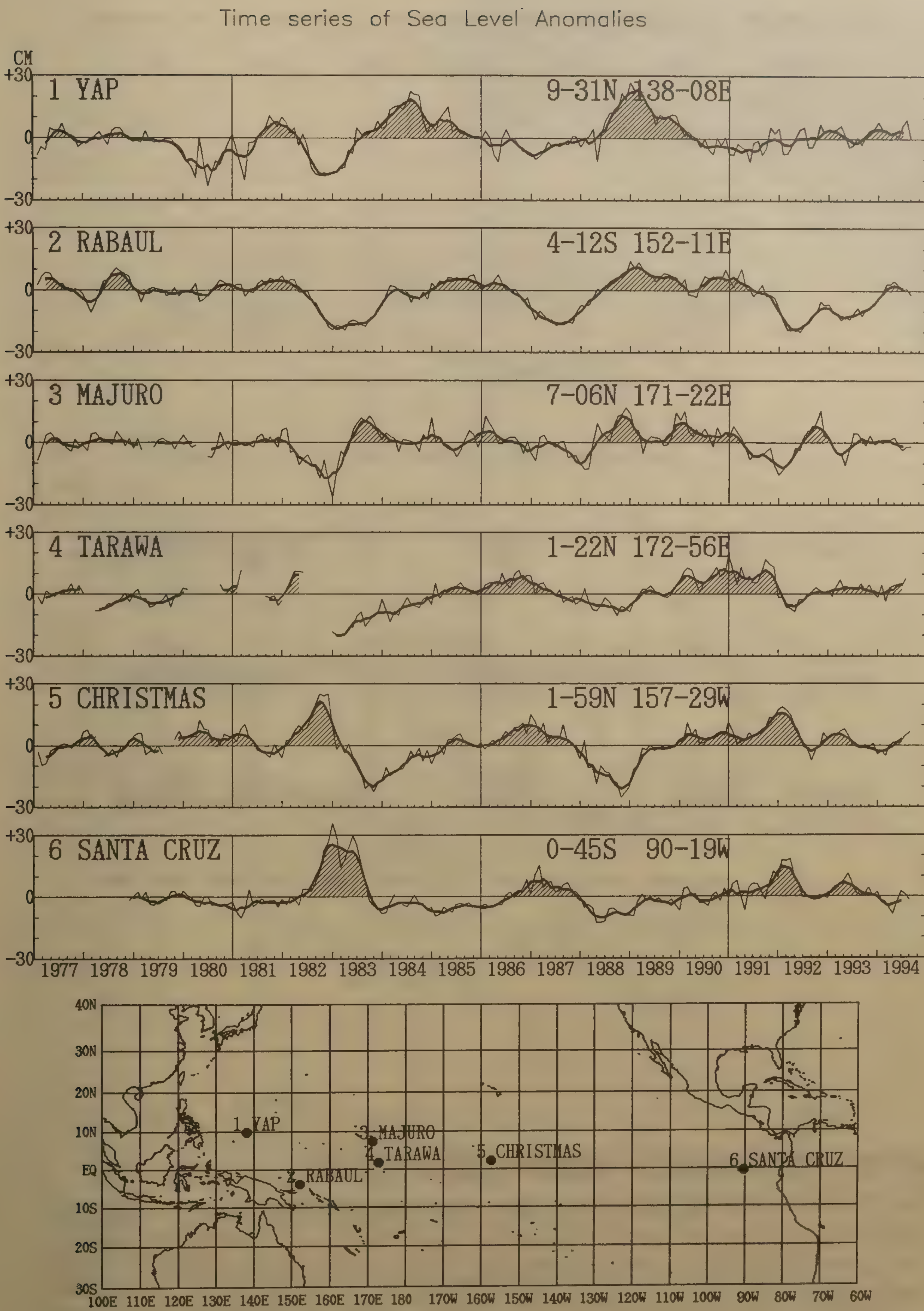
第９図　赤道太平洋表層水温時系列図（上：西部、中：中部、下：東部）

Fig.9 Time series of equatorial (2° N–2° S) subsurface temperature for the western Pacific (top, 150–160° E), the central Pacific (middle, 170–160° W) and the eastern Pacific (bottom, 100–90° W). The contour interval is 1° C with spotted shading for the values greater than 28° C.



第10図　太平洋の赤道に沿う20℃深度時系列図

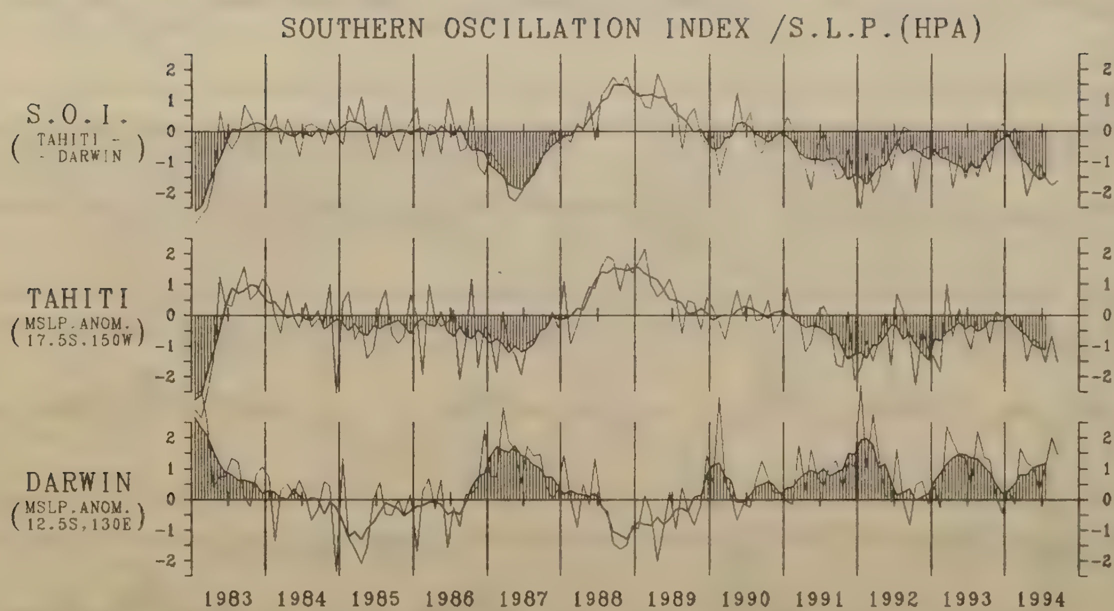
Fig.10 Time-longitude section of the depth of a 20° C isotherm along the equator in the Pacific Ocean. The contour interval is 20m with thick contour lines at 100m. Values shallower than 60m are shaded and those deeper than 140m are stippled.



第11図　太平洋月平均海面水位偏差時系列図

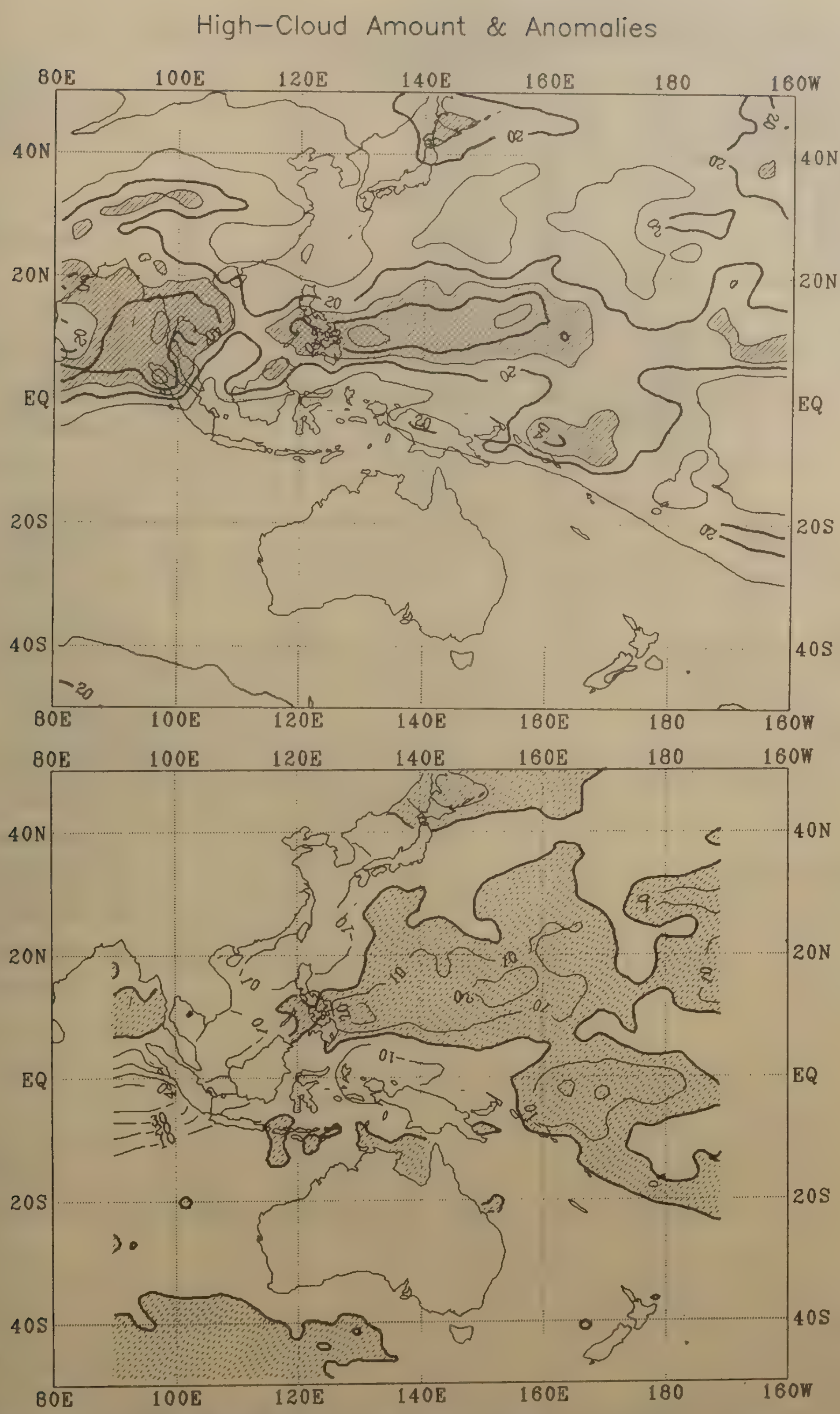
Fig.11 Time series of sea level anomalies based on 1976 to 1990 monthly mean sea level obtained from the stations indicated at the bottom of the figure. Thin lines show the monthly mean and thick lines show their 5 month running mean. Positive anomalies are shaded.

Time series of SOI & Sea Level Pressure Standardized Anomalies



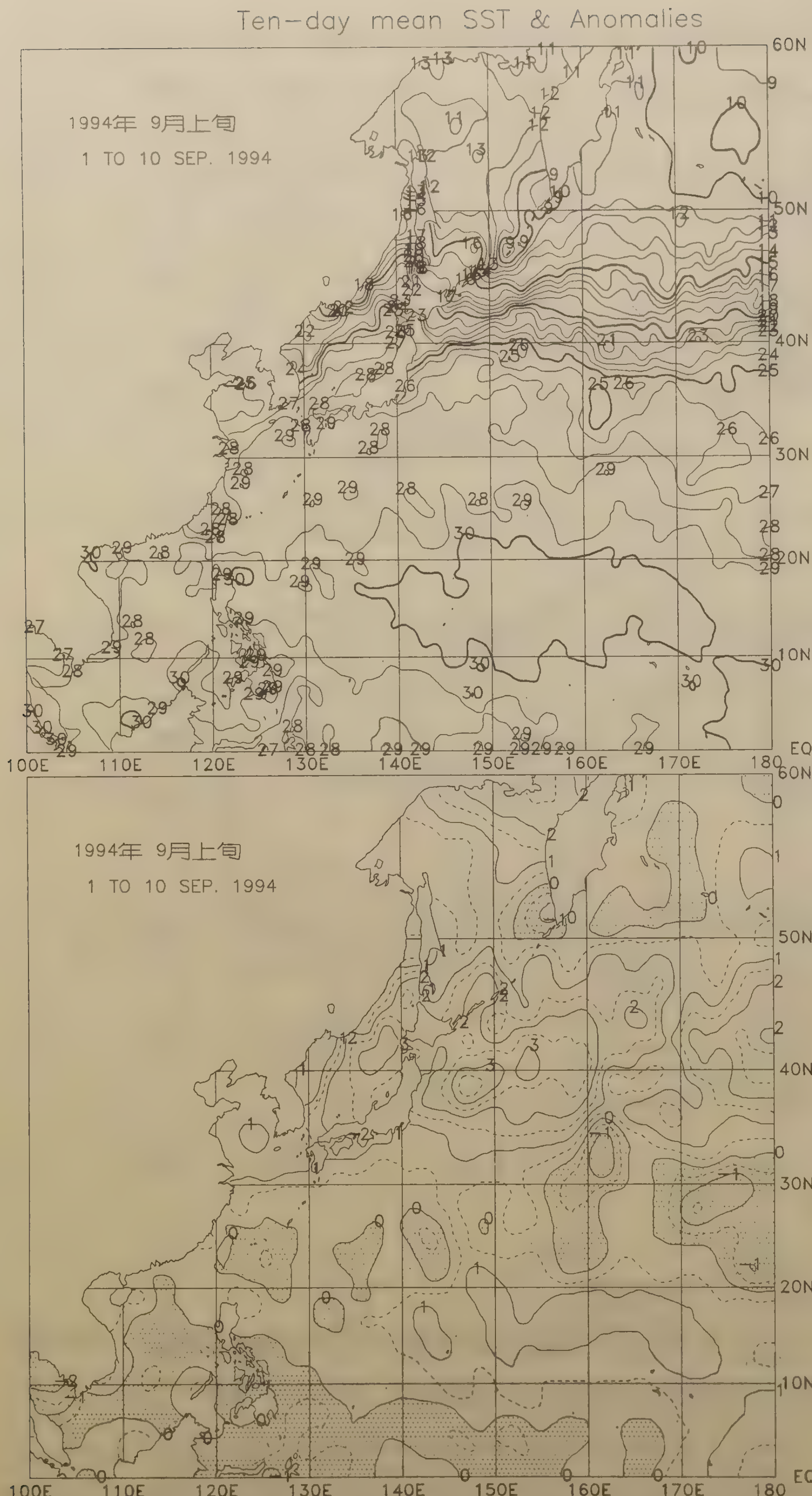
第12図　南方振動指数及び海面気圧偏差時系列図

Fig.12 The Southern Oscillation Index (top) and monthly mean sea level pressure standardized anomalies at Tahiti (middle) and Darwin (bottom). Thin lines show the monthly mean and thick lines their 5 month running mean. Negative values (top, middle) and positive values (bottom) are shaded. Base periods for normals and standard deviations are 1961−1990. This figure is prepared by the Long−range Forecast Division, JMA.



第13図　月平均上層雲量分布図及び偏差図（1994年 9月）

Fig.13 Monthly mean of the high-cloud amount (%, top) and its anomalies (%, bottom) in the equatorial Pacific for SEP 1994. The contour interval is 10%. Areas above 30% are shaded (top) and positive anomalies are stippled (bottom). Anomalies represent a departure from the 1978-1990 base period monthly means. This figure is prepared by the Long-range Forecast Division, JMA.



旬平均沿岸水温(℃)
Coastal Water Temperature

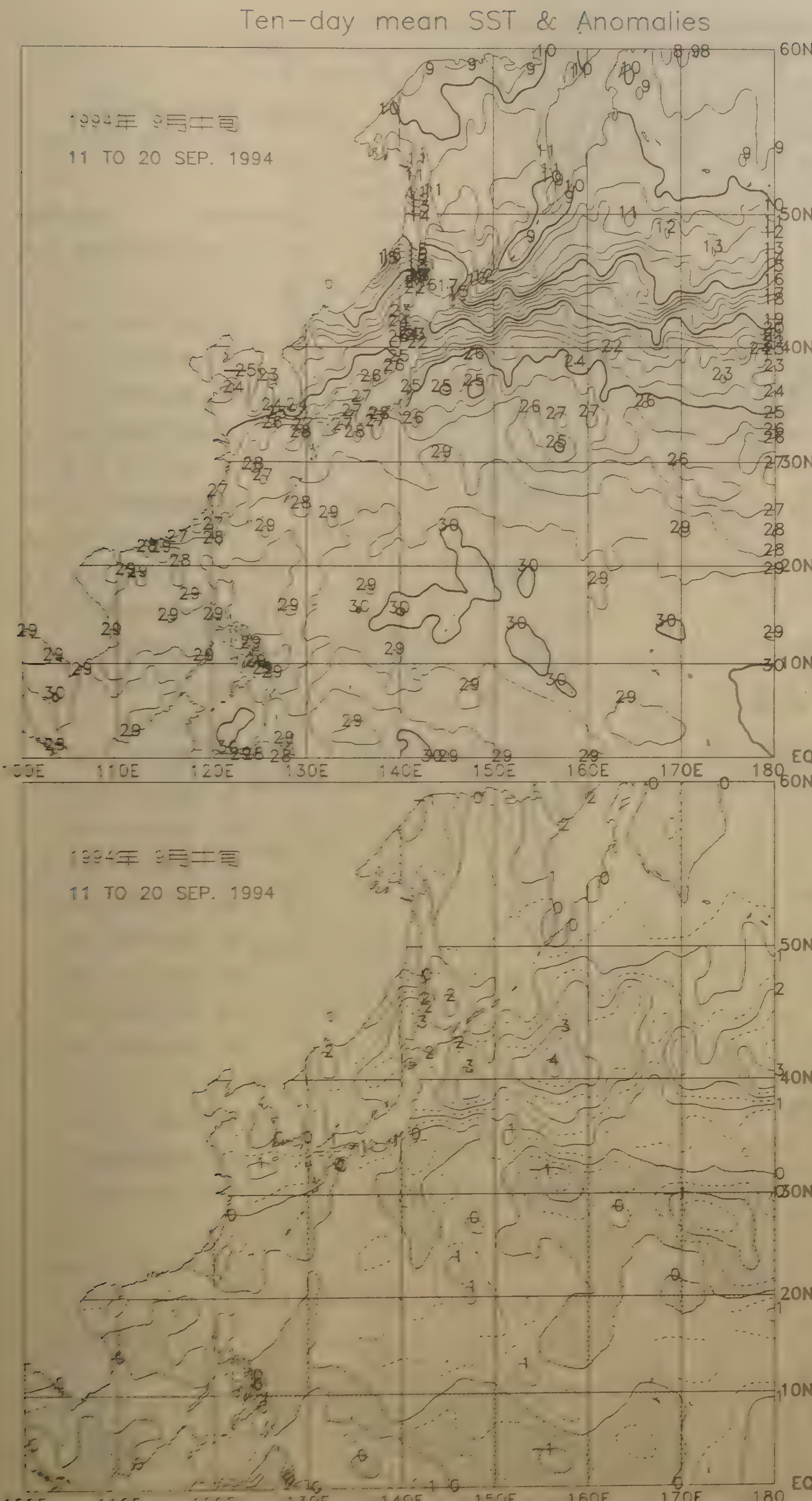
地名 (Index Number)	水温 Temp.	偏差 Anom.
石垣島 (47918)	28.3	−0.5
那覇 (47936)	28.5	+0.7
名瀬 (47909)	-	-
足摺岬 (47898)	27.8	+0.8
潮岬 (47778)	29.1	-
御前崎 (47655)	26.6	+0.8
八丈島 (47678)	26.8	−0.1
館山 (47672)	24.4	−0.1
小名浜 (47598)	23.2	+0.9
宮古 (47585)	21.8	+1.8
浦河 (47426)	-	-
紋別 (47435)	21.4	-
稚内 (47401)	22.5	-
寿都 (47421)	24.0	-
江差 (47428)	25.2	-
飛島 (47587)	27.1	+2.3
輪島 (47600)	27.9	+2.3
西郷 (47740)	27.6	-
浜田 (47755)	29.2	-
厳原 (47800)	27.4	-
牛深 (47838)	28.0	-

海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日本海	37.9N,134.5E	27.4
四国沖	29.0N,135.0E	28.3
東シナ海	28.2N,126.3E	28.9

第14図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1994年 9月上旬)

Fig.14 Ten-day mean SSTs in the western North Pacific (top) and anomalies (bottom) for the 1st ten-day period in SEP 1994. Anomalies are computed with respect to the JMA climatology (1961−90). The contour interval is 1° C and additional anomaly contours of 0.5° C are shown. Negative anomalies are stippled.



旬平均沿岸水温(℃)
Coastal Water Temperature

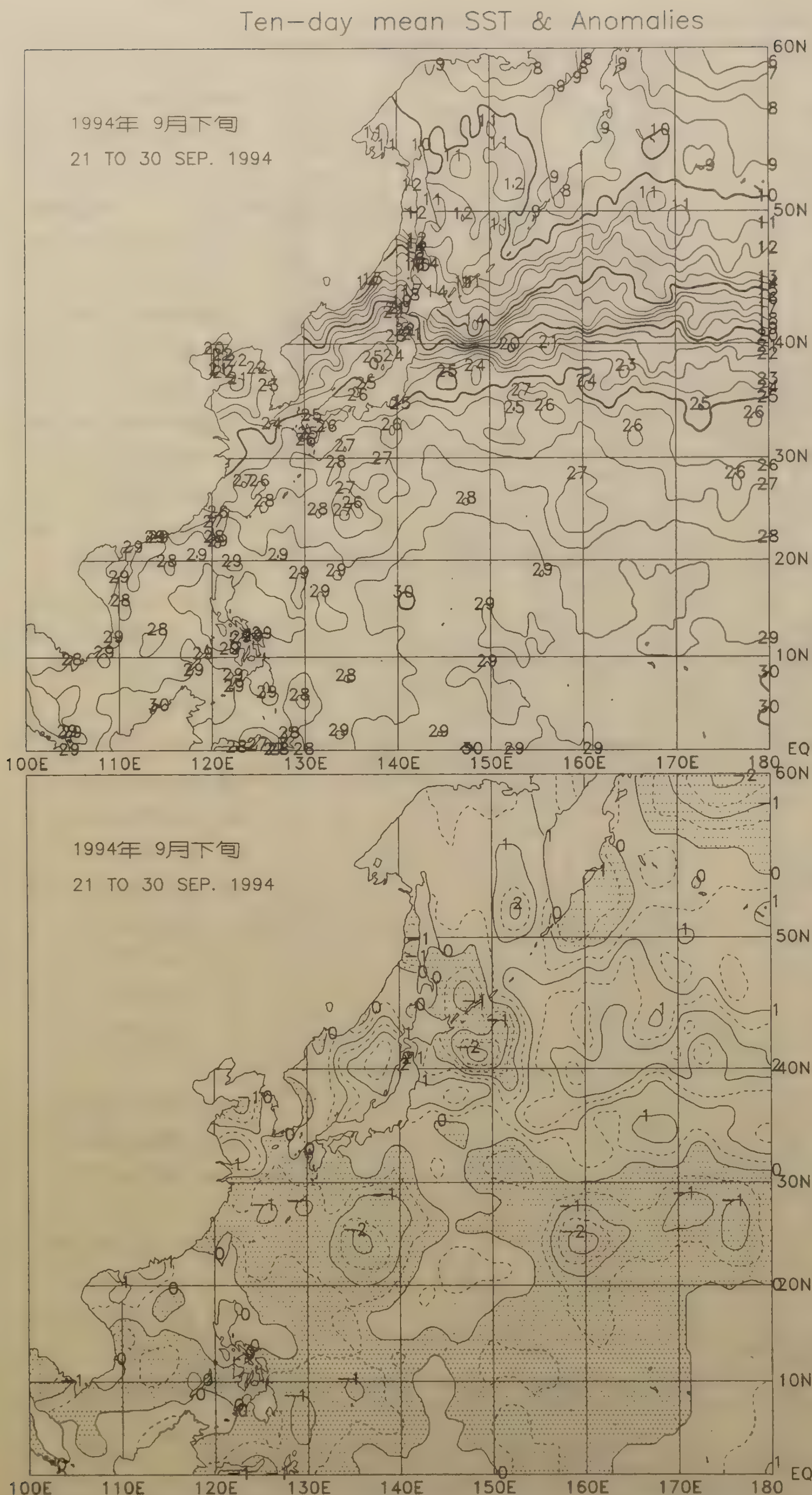
地名 (Index Number)	水温 Temp.	偏差 Anom.
石垣島(47918)	28.0	−0.4
那　覇(47936)	28.0	−0.3
名　瀬(47909)	−	−
足摺岬(47898)	26.9	+0.6
潮　岬(47778)	27.9	−
御前崎(47655)	25.7	+1.0
八丈島(47678)	26.5	0.0
館　山(47672)	24.3	+0.3
小名浜(47598)	23.5	+1.6
宮　古(47585)	21.5	+1.5
浦　河(47426)	20.0	+1.5
紋　別(47435)	19.2	−
稚　内(47401)	20.7	−
寿　都(47421)	23.2	−
江　差(47428)	24.0	−
飛　島(47587)	26.0	+2.3
輪　島(47600)	26.4	+2.3
西　郷(47740)	26.3	−
浜　田(47755)	27.0	−
厳　原(47800)	26.1	−
牛　深(47838)	26.6	−

海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日本海	37.9N,134.5E	25.3
四国沖	29.0N,135.0E	28.1
東シナ海	28.2N,126.3E	27.8

第15図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1994年 9月中旬)

Fig.15 Ten-day mean SSTs in the western North Pacific (top) and anomalies (bottom) for the 2nd ten-day period in SEP 1994. Anomalies are computed with respect to the JMA climatology (1961−90). The contour interval is 1°C and additional anomaly contours of 0.5°C are shown. Negative anomalies are stippled.



旬平均沿岸水温(℃)
Coastal Water Temperature

地名 (Index Number)	水温 Temp.	偏差 Anom.
石垣島(47918)	26.8	−1.1
那　覇(47936)	26.5	−1.4
名　瀬(47909)	−	−
足摺岬(47898)	25.6	0.0
潮　岬(47778)	26.4	−
御前崎(47655)	24.2	+0.7
八丈島(47678)	25.9	0.0
館　山(47672)	23.9	+0.6
小名浜(47598)	22.9	+1.4
宮　古(47585)	19.6	0.0
浦　河(47426)	19.8	+2.6
紋　別(47435)	14.3	−
稚　内(47401)	15.8	−
寿　都(47421)	21.2	−
江　差(47428)	22.3	−
飛　島(47587)	24.6	+2.1
輪　島(47600)	24.8	+2.2
西　郷(47740)	24.9	−
浜　田(47755)	25.5	−
厳　原(47800)	25.0	−
牛　深(47838)	25.3	−

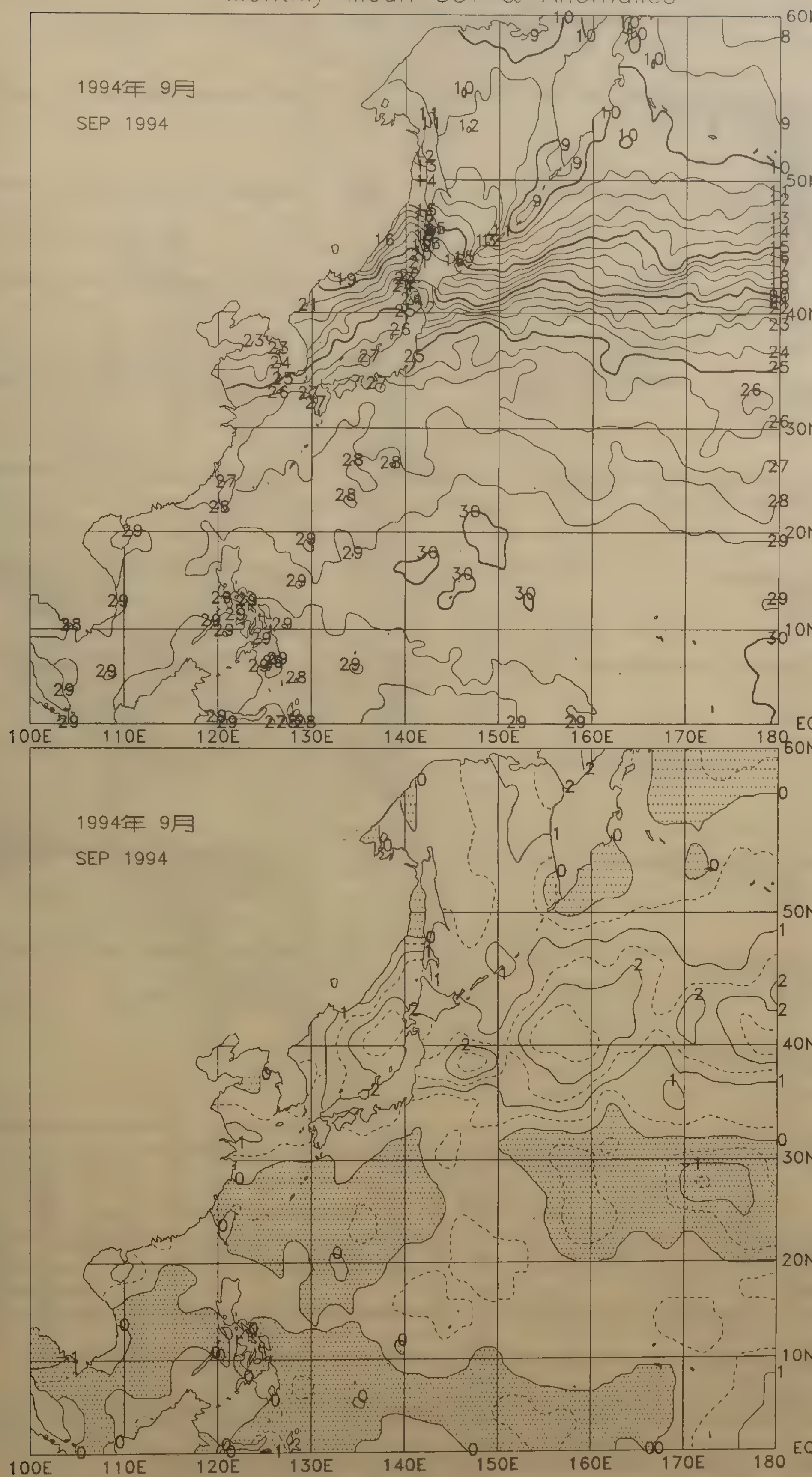
海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日本海	37.9N,134.5E	23.5
四国沖	29.0N,135.0E	27.3
東シナ海	28.2N,126.3E	26.8

第16図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1994年 9月下旬)

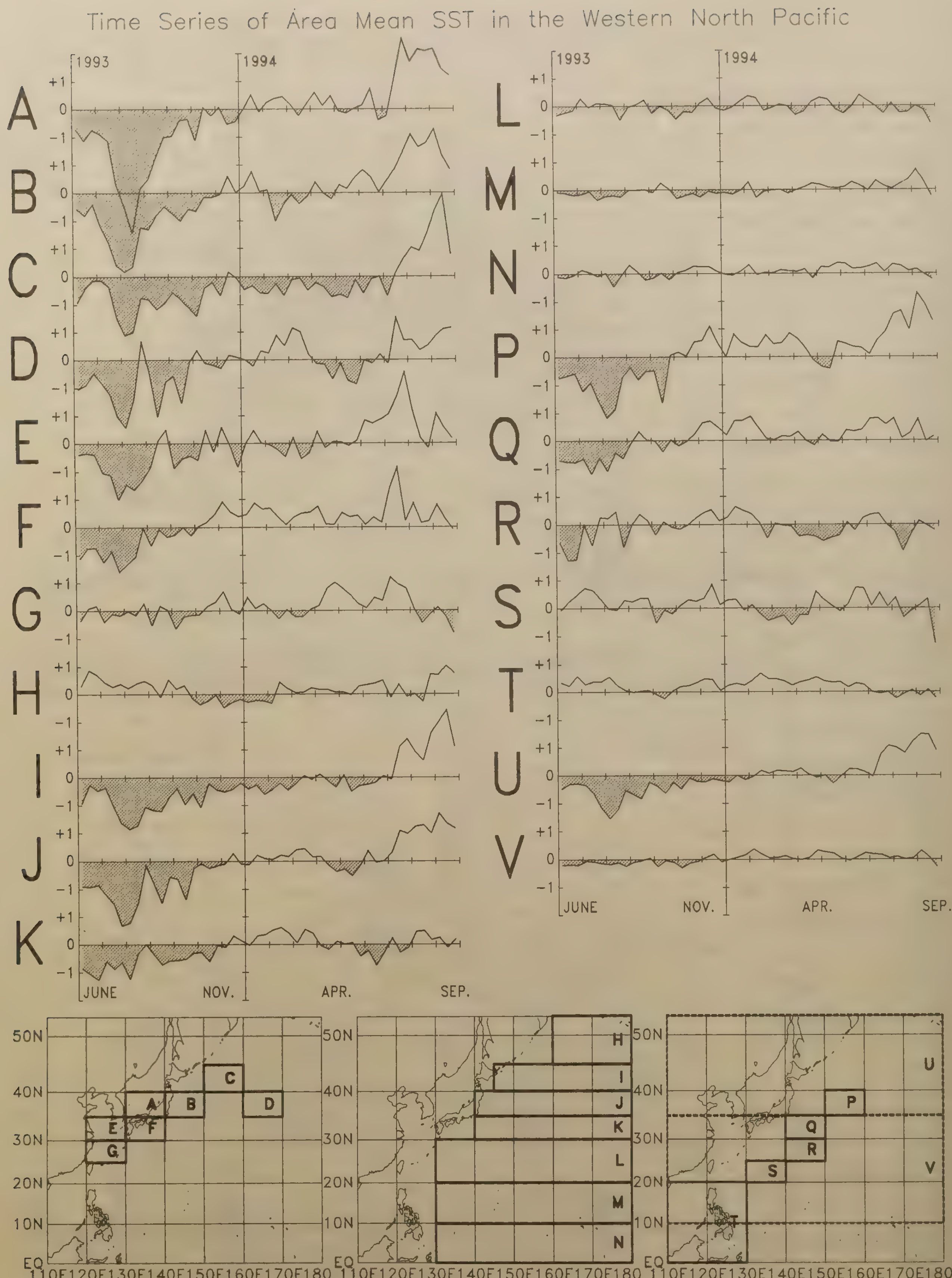
Fig.16 Ten-day mean SSTs in the western North Pacific (top) and anomalies (bottom) for the 3rd ten-day period in SEP 1994. Anomalies are computed with respect to the JMA climatology (1961−90). The contour interval is 1°C and additional anomaly contours of 0.5°C are shown. Negative anomalies are stippled.

Monthly Mean SST & Anomalies



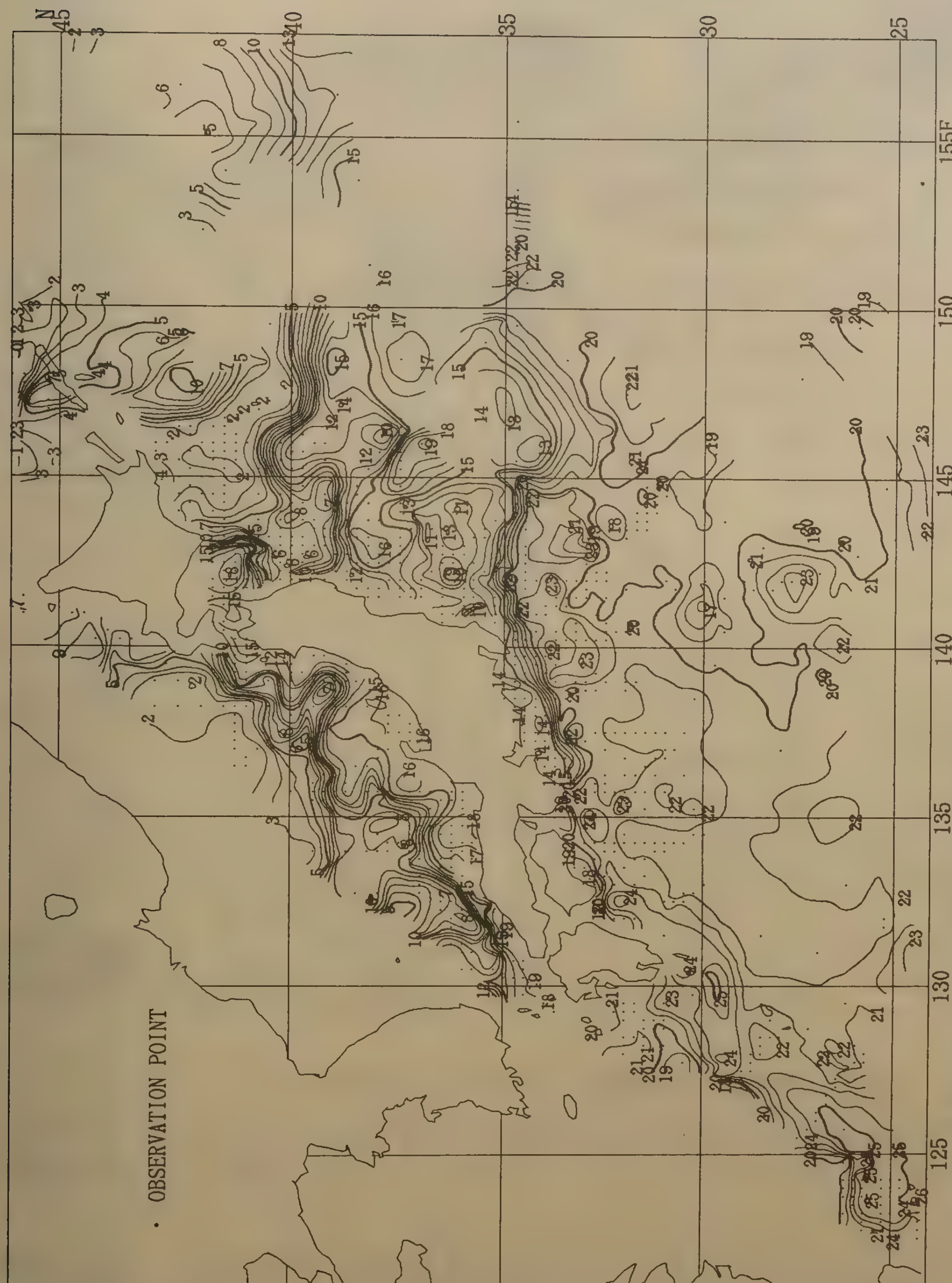
第17図 北西太平洋月平均海面水温図(上)及び偏差図(下)(1994年 9月)

Fig.17 Monthly mean SSTs in the western North Pacific (top) and anomalies (bottom) for SEP 1994. Anomalies are computed with respect to the JMA climatology (1961–90). The contour interval is 1° C and additional anomaly contours of 0.5° C are shown. Negative anomalies are stippled.



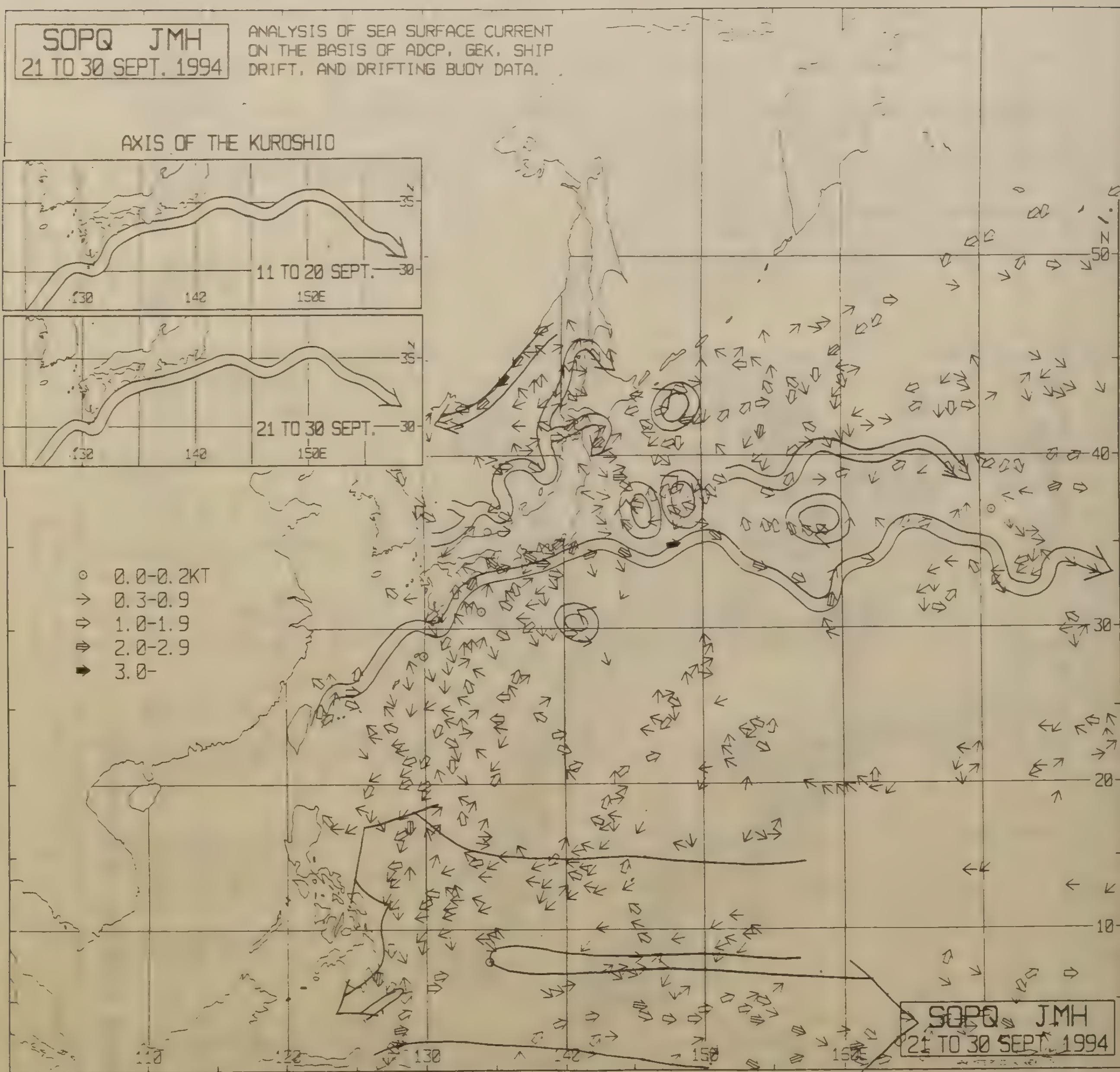
第18図　北西太平洋旬平均海面水温平年偏差時系列図

Fig.18 Time series of the ten-day mean sea surface temperature anomalies (°C) in the western North Pacific for the areas indicated at the bottom. Negative anomalies are shaded. Anomalies are computed with respect to the JMA climatology (1961−90).



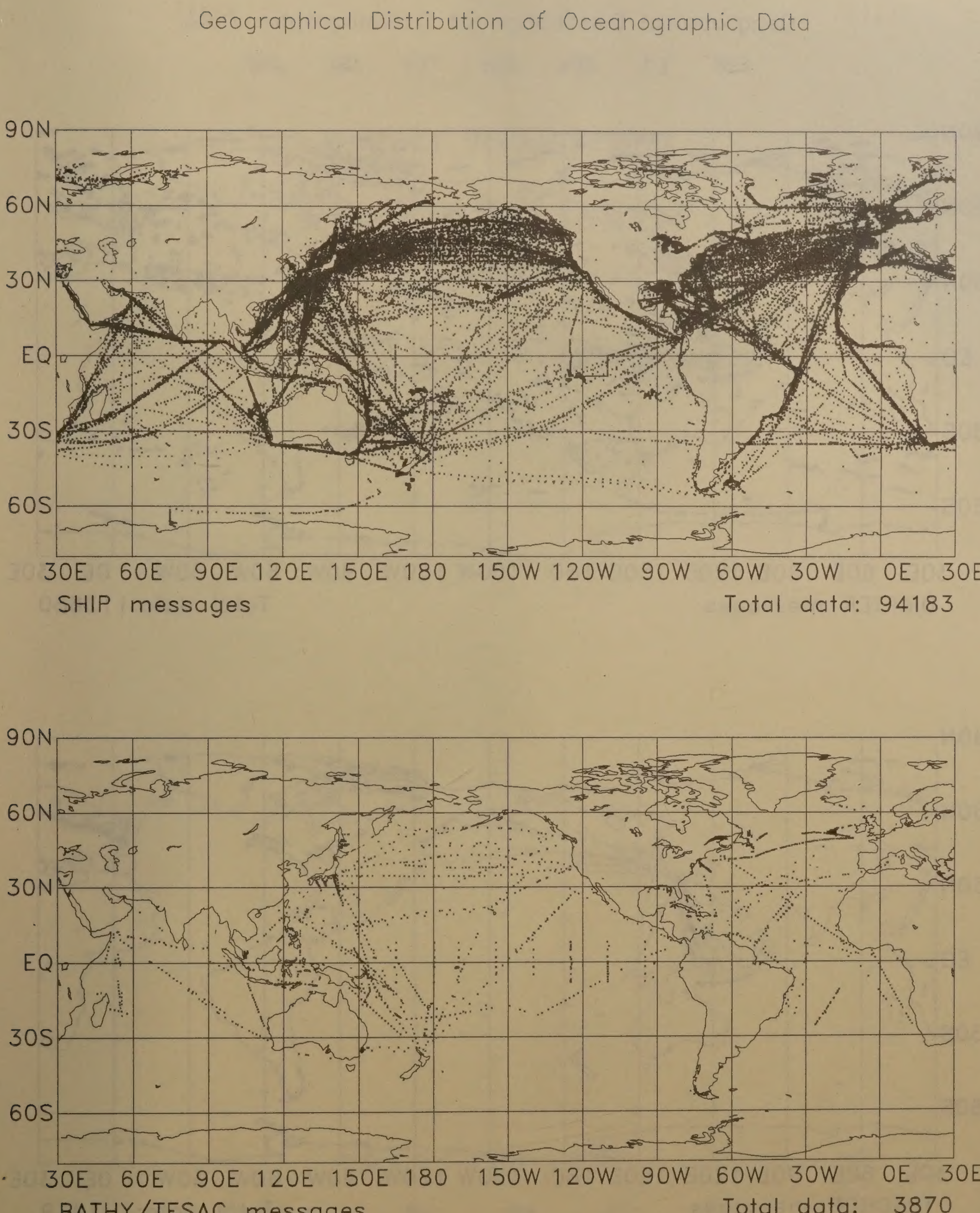
第19図　日本近海表層水温（深さ100M）図（1994年 9月）

Fig.19　Subsurface (100m) temperatures in seas adjacent to Japan for SEP 1994.



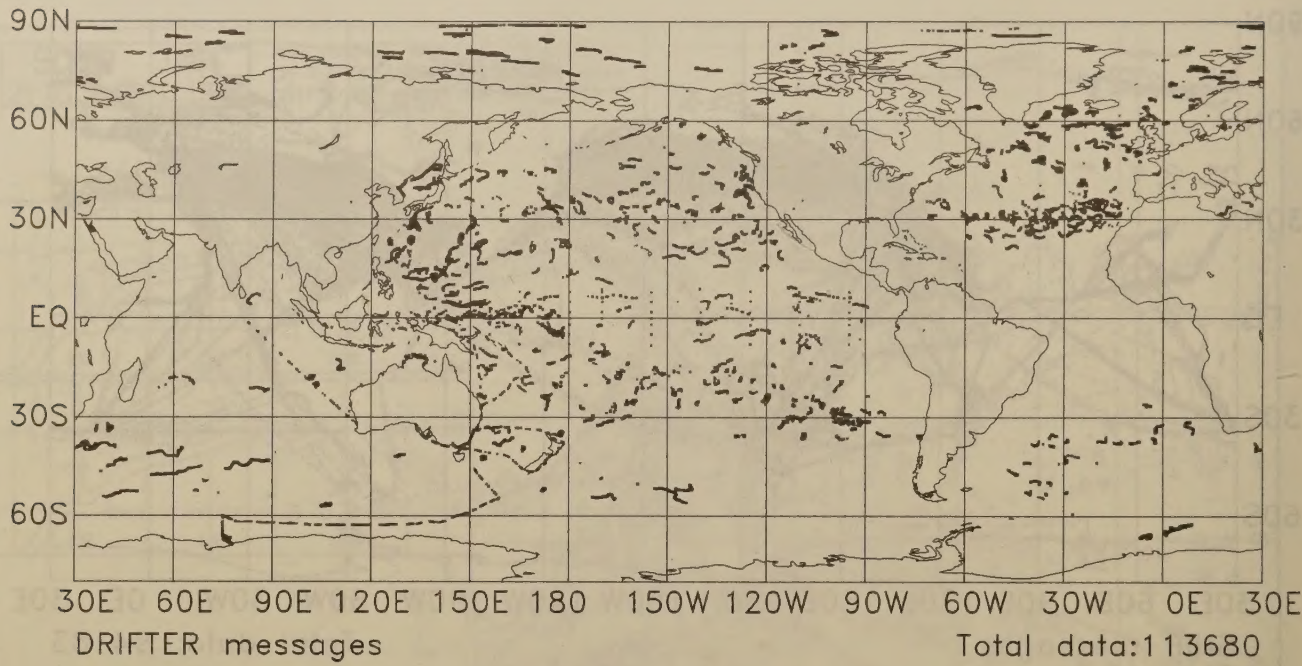
第20図　北西太平洋旬平均海流図（1994年 9月下旬）

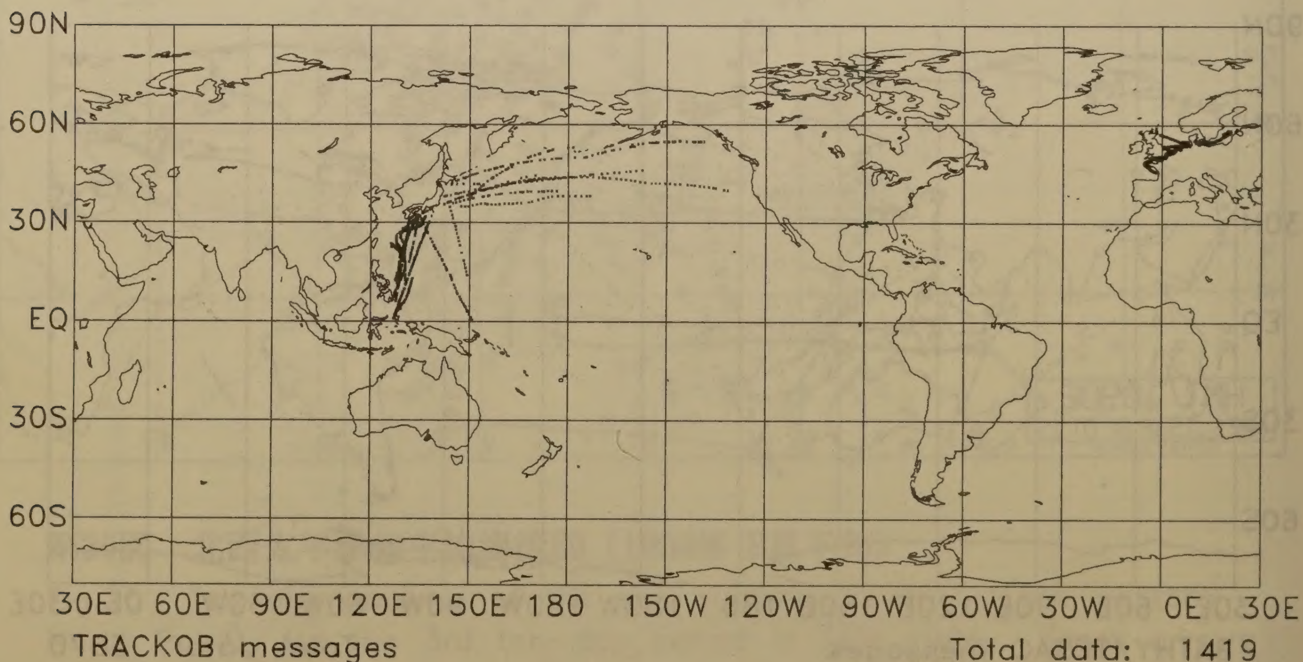
Fig.20 Ten-day analysis of the sea surface current in the western North Pacific for the 3rd ten-day period in SEP 1994. Small arrows indicate sea surface currents measured with acoustic Doppler current profilers, GEKs deployed in research vessels, and ship drift by merchant ships/drifting buoys during the month. Major currents such as the Kuroshio and the North Equatorial Current are denoted by larger open arrows.



第21-1図　測点分布図(1994年 9月)

Fig.21−1　Geographical distribution of SHIP messages (SST data, top) and BATHY/TESAC messages (subsurface temperature data, bottom) for SEP 1994.





第21-2図　測点分布図(1994年 9月)

Fig.21-2 Geographical distribution of DRIFTER messages (buoy drift and SST data, top) and TRACKOB messages (ship drift and SST data, bottom) for SEP 1994.

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